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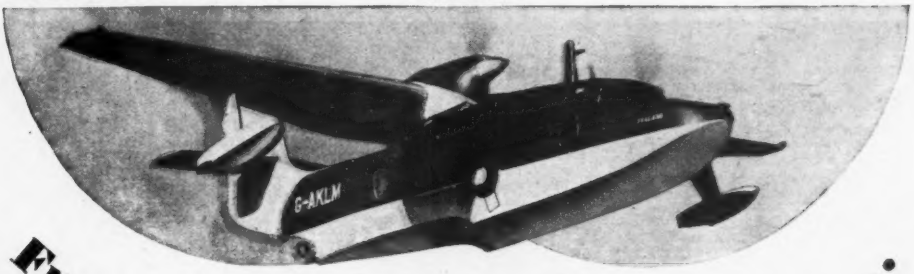
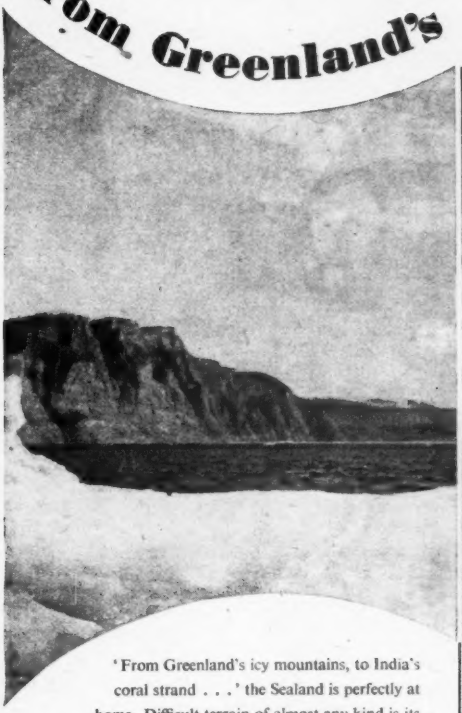
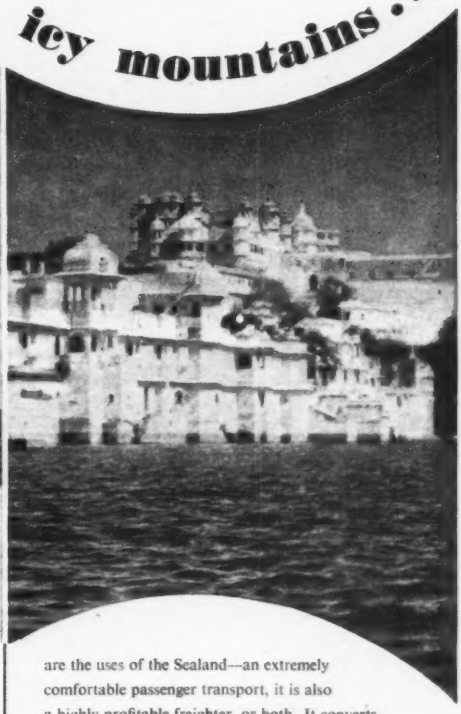


From Greenland's icy mountains . . .





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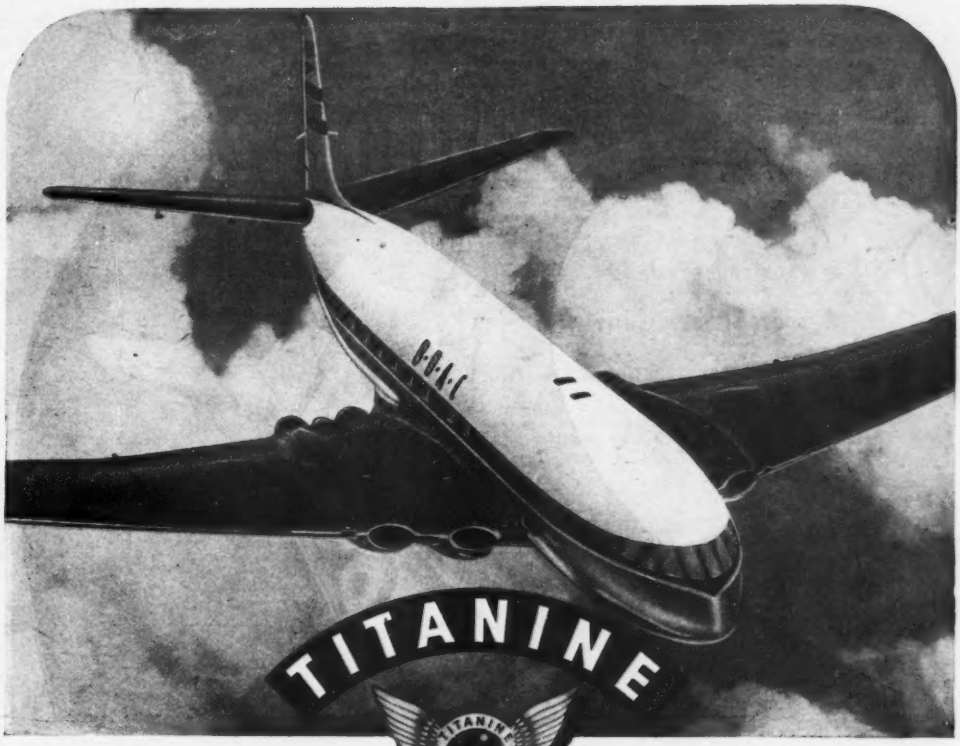

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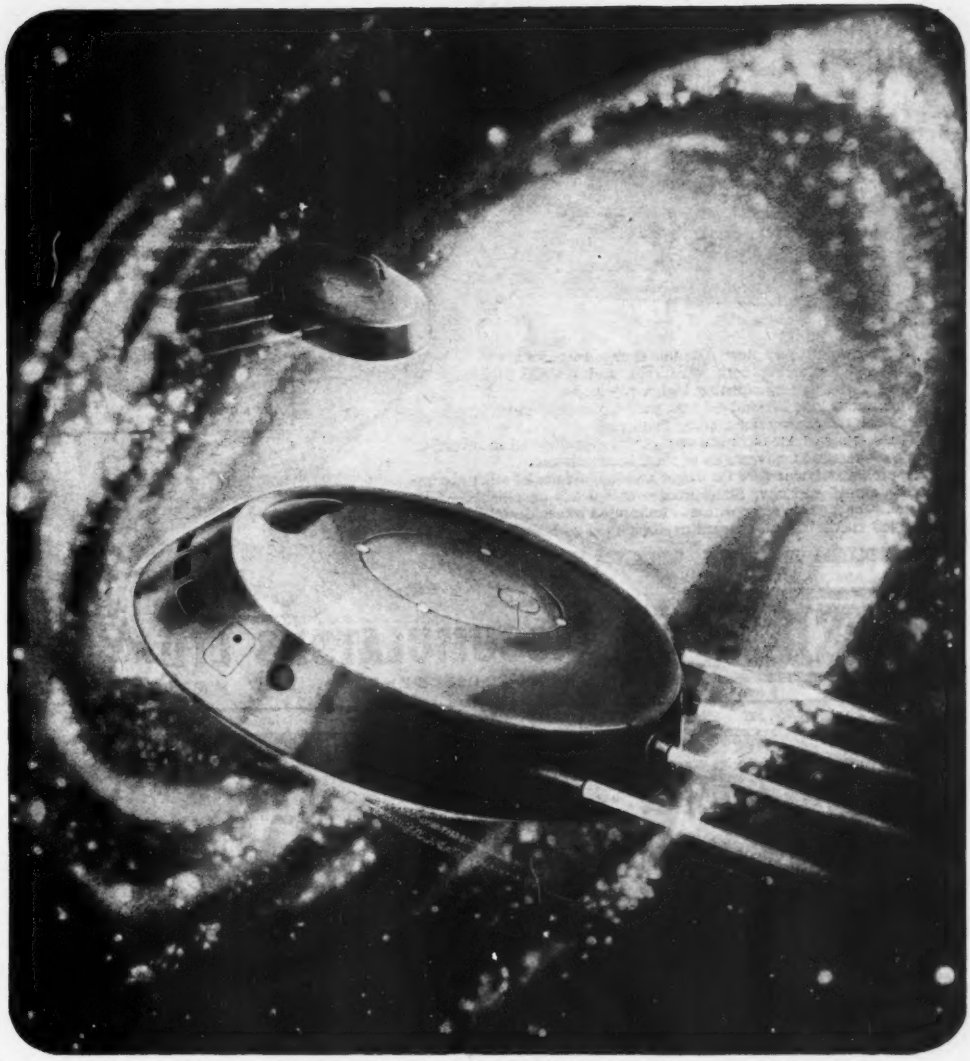

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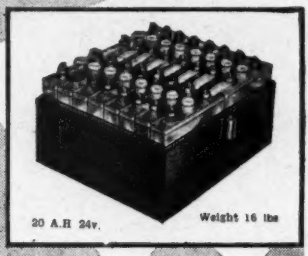

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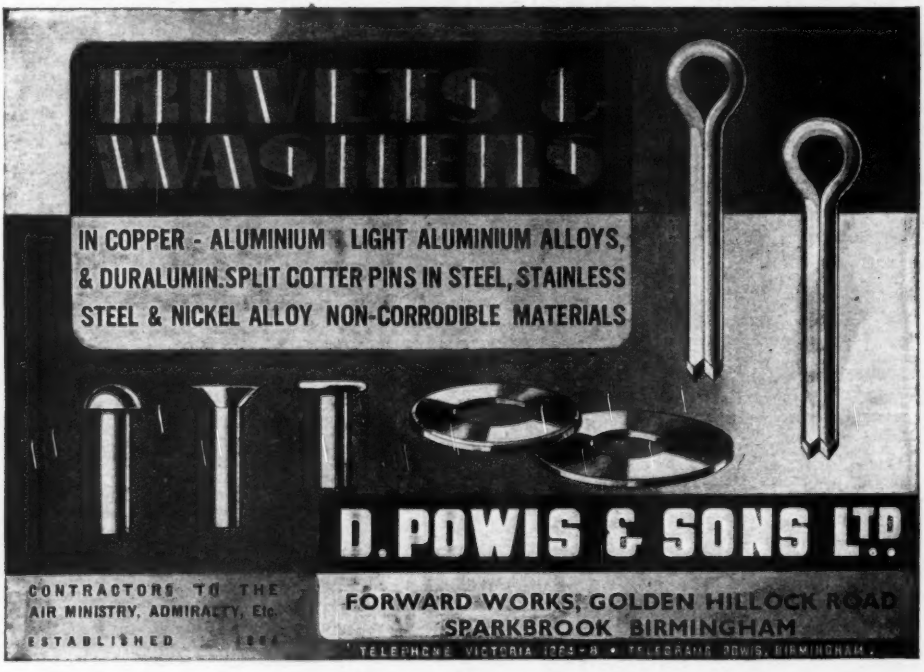
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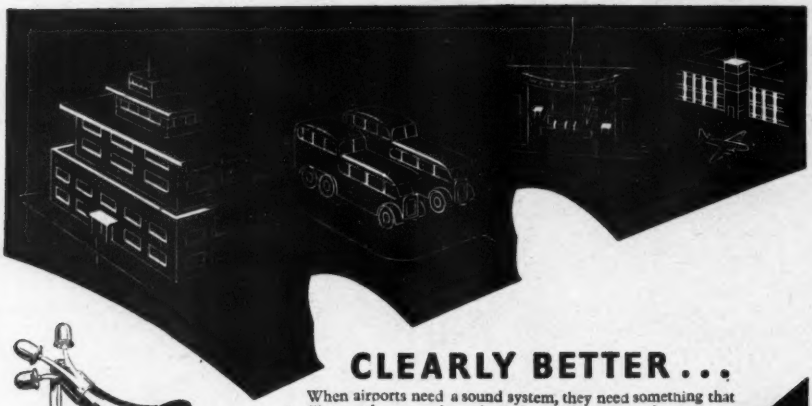

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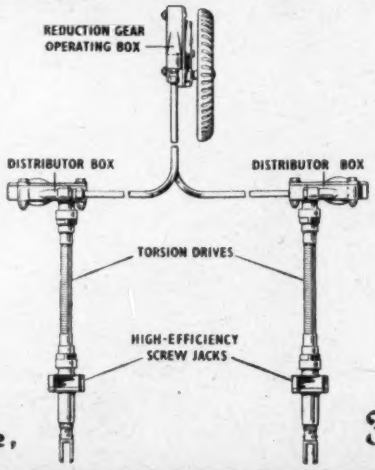

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Letting the Side Down

A FINE of £50, imposed last week under the Official Secrets Act on a young aeronautical enthusiast who endeavoured to obtain information to which he was not entitled, and £50 penalties on two others involved, underlines the fact that what has come to be known as "security" is in many ways even more vital than it was during the 1939-1945 period.

In the case in question it was acknowledged that there was no traitorous intent: that the collection of information about new aircraft was merely the result of a keen interest in them. But the outcome should be a warning to all enthusiasts, young and old alike. The authorities are under no illusions as to the diligence of unfriendly Powers in collecting every snippet in order to build up the complete pictures they so ardently desire; and such scraps, once they pass outside official boundaries, have a habit of travelling far and fast.

There is another important aspect of the matter. In common with other responsible journals, *Flight* endeavours to abide loyally by official requirements of secrecy, but frequently we find that information which we have withheld receives prominence in papers published abroad; as often as not, such disclosures concern developments in this country. On occasions, too, the insecurity virus even seems to affect British journalists writing for American papers. With the United States, in particular, Great Britain ought to have the closest understanding on security measures. We believe that in official circles existing arrangements are satisfactory—or very soon will be—in spite of the difficulties of co-ordination which must result when two countries exchange technical information and both build and use each other's equipment.

We do not advocate at this stage a martial-law type of censorship anywhere: we plead only for a greater sense of patriotism—for it is nothing less—in these matters.

Justice ?

BEFORE the war a large number of young men volunteered for Reserve service, and upon acceptance were given the rank of sergeant pilot. This seemed fair enough to them, although, understandably, it did not please many of the old sweats in the regular Service. It proved, incidentally, to be the start of a scale-down of rank values and led indirectly to an illogicality which is still with us—that of the flying and N.C.O. ranks. From the flying point of view, as captaincy of new and more elaborate aircraft added to the responsibilities of the pilot, these earlier V.R.s quickly justified the granting on attestation of their relatively exalted rank; administratively, most of them knew very little.

Soon after war broke out some thousands of V.R. pilots were fed out to all Commands, and among other duties that of flying instructor came the way of a good number of them. For the most part, they continued in the rank of sergeant pilot or perhaps flight sergeant. As the months passed their conscripted pupils completed their flying training and a good proportion were commissioned; their equally well or perhaps even better qualified instructors, buried in Training Command, remained N.C.O.s. This naturally led to much discouragement and some hard feelings. Eventually, after two or three years of war, the majority of the pre-war V.R.s who were worth a commission belatedly received one, and so the matter became a thing of the past.

But, if they are again to be called upon, what is going to happen to those who to-day are members once more of the R.A.F.V.R.? Indications are that, while many experienced commissioned pilots have dropped a few rings on going back into voluntary training, their less enthusiastic and less energetic fellows have retained a courtesy rank—the highest that they enjoyed during the war—and would, in emergency, be recalled in that rank. This cannot be called justice, and proper arrangements should be made for fairer treatment. Senior members of the R.A.F.V.R. are looking for reassurance that they will not be penalized in rank as a result of giving their spare time to flying, lectures and Link, in order to be better prepared should the call come.

TRAFFIC-CONTROL UNIVERSITY

How the R.A.F. Trains Service and Civil Pupils at Shawbury

Illustrated by "Flight" photographs.

With a duplicate control-room built on top of the normal "office," the tower at Shawbury serves a dual purpose by providing experience for students in handling actual aircraft movements. Normal and duplicate control rooms are illustrated in their relative positions on the facing page.

IN no other sphere of aviation, perhaps, does such a large measure of responsibility devolve upon the individual as in the now highly specialized field of air-traffic control. It is a far cry from the days of the old "duty pilot," whose essential equipment consisted of a note-book, a quantity of pyrotechnics and, on occasions, an exceptional refinement in the form of a radio. To-day, the controller must be capable of handling hitherto undreamed-of traffic rates in all weathers, of coping with several emergencies at once and—the most complicating factor of all—of being able to deal with aircraft whose speeds of approach to his airfield may vary in extremes between 70 and 600 m.p.h. It is purely through a knowledge of radio and its allied radar equipment that the present-day traffic-controller is able to meet these stringent requirements.

A recent visit to the R.A.F. School of Air Traffic Control at Shawbury afforded an opportunity of seeing something of the training of flying-control and airfield-control officers, chiefly for the Service. (Airfield-control officers are mainly responsible for directing aircraft before take-off and after landing.) To date, the School, which was first formed at Oxford at the beginning of the second World War and was then known as the R.A.F. Regional Control School, has trained about 4,000 students of various nationalities, including many from America, the British Commonwealth and Western Union countries. In 1941 the unit was moved to Watchfield, where, although administered by the R.A.F., it was otherwise manned by civilian staff of Air Service Training, Ltd. A temporary move to Bridgnorth in 1942 was followed by a return to Watchfield. There the unit remained until last year, when it was combined with the Central Navigation School at Shawbury, Shropshire.

Drawn for the most part from former pilots and aircrew members, the student traffic-controllers normally undergo a 12-week course. Thirty-three pupils comprise each course, two of which are run simultaneously. S/L. J. A. Jarvis, D.F.C., A.F.C., is the present C.O. Although the majority of pupils are members of the R.A.F., a number of trainees sponsored by the Royal Navy, Western Union and Ministry of Civil Aviation are frequently included.

For the first fortnight, students spend their time in lecture rooms, gaining the basic knowledge on which to found their subsequent practical exercises. Three weeks of synthetic exercises in mock control-rooms are then followed by the third phase—of five week's duration—in which actual and synthetic operations are combined. The last week of the course is devoted to revision and examination. The primary object is that students should attain a standard which will enable them to take a solo watch at R.A.F. or civil airfields within a month of completing their training.

Two squadrons of communications aircraft based at Shawbury, mainly Anson Mk 21s and Wellington T.10s, give student controllers plenty of practical experience in handling actual traffic and, in fact, the control tower on the airfield has a duplicate controller's desk, located above the normal control room. Each student is given six hours actual flying experience during the course.

From the ground, the trainee is able to direct, both by day and night, procedures such as QGH descents through cloud (i.e., descents controlled from the ground by D/F. bearings) and V.H.F. homings. Later, G.C.A. and I.L.S. training will be included in the curriculum. Special facilities are used to provide constant practice in the numerous and complex flying procedures in which the modern controller must be well versed. They include two synthetic control-rooms, an R/T. practice room, an equipment demonstration room (which includes a dummy airfield for practice in flare-path layout) and a radar demonstration section. Link trainers, manned by the pupils themselves, provide practice in let-down, homing and stacking procedures and in the use of Babs. Voice-recording equipment is used to improve pupils' style of speech over the R/T.

Traffic controllers must not only understand the basic principles of many of the navigational aids used in aircraft.

G/C. B. J. R. Roberts (right) commands R.A.F. Station Shawbury, while S/L. J. A. Jarvis, D.F.C., A.F.C., is in charge of the School of Air Traffic Control. (Left) Mr. J. W. L. Ha, from the Hong Kong Department of Civil Aviation, practices approach-procedure with a simulated cathode-ray D/F unit.

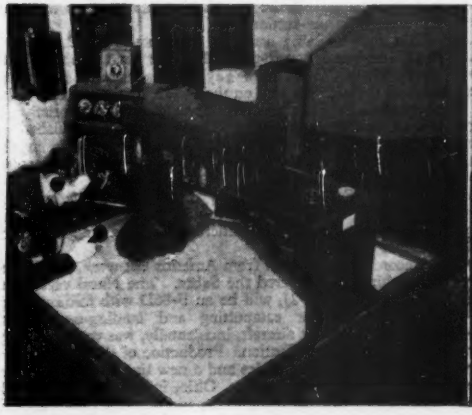
F/L. H. F. Orchard, a senior instructor who has spent eight years on flying control duties, keeps his hand in on a Mark II Gee unit.

but must also have some idea of how to use them. Accordingly, the list of up-to-date equipment and procedures on which students are given practice is indeed formidable. It includes such devices as the radio compass, Gee Mark II, the radar altimeter, Loran, H2S, the Australian multi-track range, D.M.E., the most recent type of Rebecca/Eureka/Babs (for giving the aircraft a continuous indication of range and bearing from a runway), the radio altimeter, S.C.S. 51, Gee track guide, L/F four-course range and V.H.F.-voice rotating beacon. There is also the latest type of Rebecca, designated Mark IV, which is actually a miniaturized, pressurized and tropicalized version of the well-known Mark II equipment—so modified to make it suitable for use in single-seat aircraft. In addition, pupils carry out simulated S.B.A. let-downs, and homings using cathode-ray D/F. and Eureka beacons.

The standard to which the budding controllers are trained renders them capable of coping with anything up to 50 landings per hour, but when it is realized that at R.A.F. Station, Driffield, for example, as many as 120 landings per hour are often handled, it will be seen that even after completing this course the traffic controller has by no means reached the peak of ability. In a synthetic control-room the students act, in rotation, in the capacities of controller, assistant controller, airman of the watch and telephone operator, while an instructor simulates messages from aircraft—often voiced in practically unintelligible foreign accents.

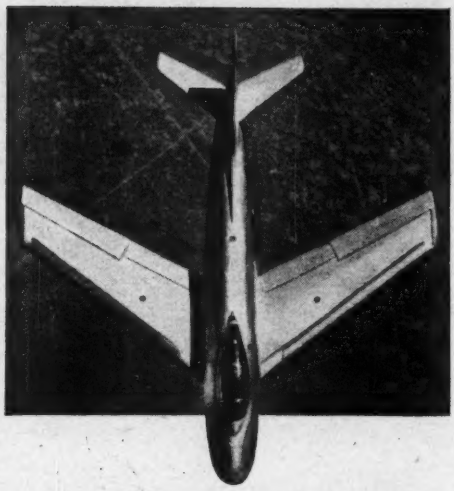
In addition to the traffic controllers' courses, the School operates a separate three-week course for runway controllers, again drawn largely from ex-aircrew, on which N.C.O.s are instructed in the duties of airfield layout, flarepaths and lighting systems, visual signalling and pyrotechnics, visual and radio landing-aids, aircraft identification and emergency procedures.

(Below, left) Another device on which aspiring controllers receive practice is the simulated Babs trainer. A Babs Type 31 is used in conjunction with a normal Link Trainer. (Right) The Naval liaison officer, Lt. G. A. Alder (who is also an instructor) discusses a QGH descent with pupils.



THE SABRE UNSHEATHED

A Topical Note on the North American F-86 : Sabres for the R.A.F.?



WHEN Russian-built Mig-15s put in their first speedy appearance over the Korean battlefront last year they constituted an immediate threat to United Nations air superiority. Fortunately this problem was soon resolved by the counter-appearance, last December, of North American F-86A Sabres and their ensuing successes against the Communist jet fighters.

In this local conflict there are broader implications. Russia is now known to have at least one fighter capable of outpacing all but one of the aircraft-types in squadron-service with the Western Union and Atlantic Treaty Powers. The exception is the Sabre. Judging by all available reports from Korea, it is the only allied fighter that can catch the Mig in level flight, whatever may be the merits, as high-altitude intercepters, escorts or ground-attack aircraft, of other types.

In these circumstances, widespread interest is being manifested in the performance of the Sabre and the majority of Western nations would welcome the opportunity to strengthen their defences with this outstanding aircraft. The following digest of such information as may be published should satisfy the natural demand for details.

Initial design-work had begun when the decision was made (after study of late-wartime German aerodynamic development) to replace the Sabre's original straight wings by the present type with 35-deg sweep-back. The prototype XF-86, powered by an Allison J-35 turbojet, made its first flight on October 1st, 1947, and the F-86A production version (with General Electric J-47 of 5,200 lb thrust) first flew on May 20th, 1948. Four months later Maj. R. L. Johnson set up the present world's speed record of 671 m.p.h. in a fully armed F-86A. According to the most recent announcements, 554 F-86s have been delivered to, or are on order for, the U.S.A.F., although contracts have probably been increased since the Korean crisis. With the exception of those in Korea, all the U.S.A.F.'s Sabres are in service with day-fighter squadrons defending the United States.

Design of the F-86A is straightforward. The J-47 turbojet is mounted in the fuselage aft of the wings; the rear fuselage and tail unit are quickly detachable to facilitate servicing. Straight-through delivery is provided from a nose-intake, which is lipped above to maintain airflow in a nose-up attitude (the Sabre lands and takes off at a nose-high angle of 25 deg).

A thin, laminar-flow wing section is employed. Wing construction is all-metal, and special milling machines are used by North American to produce the tapered aluminium skins. Automatic slats are carried by the leading edge to maintain airflow at low speeds, in combination with slotted flaps. Two door-type dive-brakes open forward from the fuselage sides. The tail unit, like the wings, is of all-metal construction and all surfaces are swept back 35 deg.

The pilot's pressurized cockpit is provided with heating and refrigeration, according to conditions, and an ejector seat. The canopy, of curved glass, has the conventional bubble profile. Armament of the Sabre is not heavy: it consists of six 0.5-in guns mounted in the nose. For ground-attack duties, the aircraft can carry two 1,000-lb bombs or sixteen 5-in rockets. The external tanks, which would appear to contain about 200 gallons each, are carried under the wings outboard of the main undercarriage legs; they may be retained for combat. Larger tanks may be fitted for ferrying, giving a range of 2,350 miles.

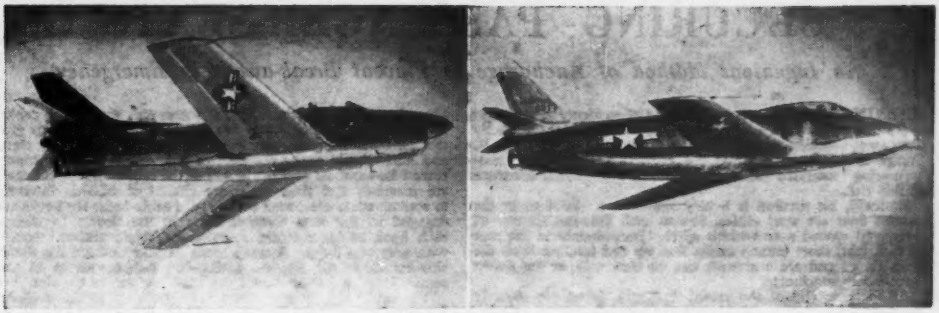
Continuous development generally follows the introduction of a good military aircraft, and here the Sabre is no exception. Three separate variants have stemmed from the F-86A, which has now been replaced on the assembly lines by the F-86E. This resembles the "A" externally, but incorporates an improved system of pilot's control. In the F-86E, the variable-incidence tailplane has been linked to the elevators to increase control-effectiveness under heavy loading at high speeds. The aileron and elevator controls are completely powered—the pilot no longer supplying any of the force to move them—and the F-86E system incorporates "artificial feel" to give an idea of control reactions. This synthetic sense increases when longitudinal control is effected by excessive loads on the tail, providing "irreversible" elevator control.

Also in production now is the F-86D, a radar-equipped all-weather version of the Sabre. On this type the "lip" over the intake characterizing the F-86A and E has been extended into a "nose" housing airborne-interception radar, and the intake itself has taken on an elliptical shape. In addition, the F-86D has acquired an afterburner for increased rate of climb. This attachment, it has been estimated, increases the thrust of the J-47 to 7,000 lb on take-off when used with a fixed-area tailpipe nozzle, as incorporated in the prototype F-86D. A third modification is the use of a thinner tailplane-section.

The fourth Sabre variant, designated YF-93A, has a British-designed power-unit—the Pratt and Whitney J-48 Turbo-Wasp (Rolls-Royce Tay). This turbojet is rated at 6,250 lb thrust, increased on the F-93A by the use of a Solar afterburner. Of the quartet, this version has potentially the highest performance. The F-93 is easily distinguished by its rounded nose and N.A.C.A. flush air-intakes in the fuselage-sides. It also displays a new type of undercarriage with dual main wheels.

Both the F-86D and F-93A gain in performance by virtue of increased thrust, but their handling characteristics at altitude may be impaired by increased all-up weight for the same wing-area.

According to a report from America last week, the United States Navy has ordered the Sabre. The Naval version, to be known as the F2J, will be an F-86D with folding wings and provision for catapulting and landing-on. North American's first jet aircraft, incidentally, was the FJ-1 Fury, built to Naval specification. Production of the Sabre is now undertaken at Los Angeles and a new line is expected to be set up shortly at Columbus, Ohio, in the factory formerly operated by Curtiss-Wright. In addition, the Sabre is being



Latest Sabres: The F-86D (left) all-weather intercepter and the F-93, which is powered with an American-built Tay turbojet, the J-48.

produced under licence at Montreal by Canadair, Ltd., for the R.C.A.F. The first Canadian-built machine, an F-86A, came off the assembly-line last August. One Sabre is being test-flown at Muroc with a powerful Canadian turbojet, the Avro Canada Orenda, which may be installed in later examples of the 100 Sabres ordered from Canadair by the R.C.A.F. (this figure may, of course, have been increased within recent weeks).

Replying to a question in the House of Commons last week, the Air Minister, Mr. Henderson, revealed that "No decision has been made to equip the R.A.F. with the F-86 Sabre, though a proposal of this kind is under examination." Here was the first official expression on a subject which had been discussed publicly for several weeks, the presence of two Sabres at the R.A.F. Central Fighter Establishment adding weight to the rumours. Although it is not our purpose here to comment on Britain's lack of a Sabre-counterpart *in production* (the industry could certainly have built such an aircraft in quantity if the decision to do so had been taken soon enough), one point seems to require qualification. Should the R.A.F. decide that Sabres were a necessary part of our air defence, their purchase from America would presumably be a temporary expedient, pending the delivery of faster British fighters. Whether or not America (bearing in mind the demands of her own defences) would be able to supply Sabres during that interim period is another matter.

NORTH AMERICAN F-86A SABRE

General Electric J-47A turbojet (5,200lb max static thrust)

Span	37ft 1in
Length	37ft 6in
Height	14ft
Gross wing area	274 sq ft
Gross weight	13,715lb
Max. speed	Over 650 m.p.h.
Service ceiling	Over 40,000ft
Tactical radius	535 miles
Normal cruising range	1,250 miles

W/C D. S. K. CROSBIE

WE regret to record that W/C. Dudley S. K. Crosbie, O.B.E., R.A.F.(Ret.), died at Olney, Bucks, on January 29th. He was manager of the de Havilland branch in India—located at Karachi—from its formation in 1929 until it was closed shortly after the partition of the country.

In carrying out his duties he conscientiously served the interests of military and civil flying, particularly in the safe and satisfactory operation of school Moths, Tiger Moths and, subsequently, Chipmunks.

FILMS ABOUT STEEL

ON Thursday evening, February 1st, the famous steel-making company, Thomas Firth and John Brown, Ltd., entertained an audience of about 200 guests who saw the first showing of a new film, *Sound Steel*, produced by the Firth-Brown Research Laboratories. The film was absorbingly interesting, not only by virtue of the awe inspired by the sight of 30-ton ladles of molten metal and monstrous masses being forged under 6,000-ton hydraulic presses, but also because of the emphasis placed on the most rigid control of quality.

Another film, *River of Steel*, produced by the British Iron and Steel Federation, was also shown. The two films complemented one another very well, for *River of Steel* is an animated cartoon designed for lay audiences and explaining the basic processes of steel-making and the ubiquity of steel in everyday life, whereas *Sound Steel* is a film better suited to audiences with some knowledge of the subject-matter. Copies of *Sound Steel* are available for loan to learned societies, technical schools and so forth, by application to Thomas Firth and John Brown, Ltd., Atlas Works, Sheffield.

WILLIAMSONS REOPEN A FACTORY

SPEAKING at the 45th annual dinner of the Williamson Manufacturing Co., Ltd., held in London last Friday evening, Mr. Colin Williamson (chairman) referred to the reopening of the firm's war-time factory at Reading.

Mr. J. E. Odle, assistant managing director—who had just returned from America, where he had attended the American Photogrammetric Society's congress at the invitation of the Canadian Government—remarked on how highly regarded were Williamson designs in the United States. He had also called in at Toronto and "found the Canadian company flourishing."

This was the 45th annual dinner, but the concern is in its 63rd year. In addition to air cameras and other photogrammetric apparatus, Williamsons produce micro-film units and photo-finish cameras.

PRISING THE OYSTER

"British Test Pilots," by Geoffrey Dorman. Forbes Robertson, Ltd., 143, Fleet Street, London, E.C.4. 166 pp. Illustrated. 8s 6d.

FEW British test pilots match up with Hollywood's Technicolored portrayal of their profession; still fewer would wish to do so. On the contrary, like most people with a story worth telling, they seldom talk about their own experiences, harrowing or otherwise. It is, therefore, to Geoffrey Dorman's credit that he has persuaded 36 of our leading test pilots to say enough about themselves to fill a book; though one shudders at the thought of the hangovers it must have cost him!

It is a pity that Mr. Dorman has tried to colour his narrative with so much Service slang, which may excite younger readers, but will certainly leave the older ones mentally writhing. Apart from that, *British Test Pilots* offers an interesting biographical background against which to view the day-to-day achievements of the handful of extremely skilful and gallant men on whom the "safety, honour and welfare" of our aviation business so largely depend.

In his foreword the author gives generous credit to John Yoxall, who in the past has contributed a number of test-pilot biographies to *Flight*. "I thought they were the most interesting aviation articles I had ever read," he says. "I was extremely disappointed when John concluded his series. As I was most anxious to go on reading about the current series of test pilots, the only solution seemed to be to write about them myself. And this I have now done with John Yoxall's blessing." J. W. R. T.

[Incidentally, Mr. Dorman has written to us to point out that in his book he has inadvertently given the year of John Cunningham's birth as 1912 instead of 1917. "I know that most D.H. products appear ahead of schedule," he says, "but this was merely careless proof-reading on my part."—ED.]

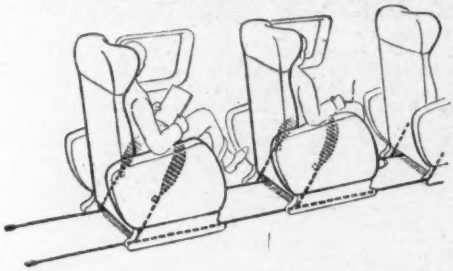
SECURING PASSENGER-SEATS

An Ingenious Method of Anchorage to Prevent Break-aways in Emergency

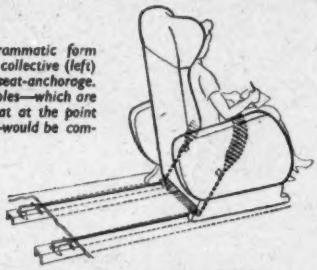
HAVING studied details of a number of accidents to passenger aircraft in which casualties resulted directly or indirectly from seats breaking away from their floor anchorages, Mr. J. R. Sturge Whiting, of Reading, has evolved a system of "seat-harnessing" intended to reduce, or entirely prevent, the incidence of this risk.

Basically, his method is a very simple one. Laid along the aircraft floor are steel cables, two to each fore-and-aft row of seats, and spaced a seat-width apart. Immediately to the rear of each seat, short branch cables lead up and forward from the main cables and are anchored, one on each side, at the points of seat-belt attachment.

At the rear end of the cabin, the main cables are securely anchored in a plate or plates built into the floor. The design



Shown here in diagrammatic form are the systems for collective (left) and independent seat-anchorage. In each case the cables—which are attached to the seat at the point of belt-attachment—would be completely concealed.



of the anchorages is such that a crash load, transmitted nearly horizontally by the main cables, tends to transfer itself into the floor structure in terms of longitudinal compression rather than of lateral shear.

The whole of the harness system would be concealed, the main cables beneath the floor-carpeting and the branches within the covered-in seat-sides.

From his studies of accident-analyses, Mr. Sturge Whiting feels that in any crash not sufficiently severe to wreck the fuselage structure completely, the g-load on the seat-belts would be unlikely, in itself, to cause serious injury. Nevertheless, he is a staunch supporter of the rearward-facing seat and it is clear that his harness-system, in slightly modified form, could be conveniently applied to such installations.

In another version of his design, the inventor dispenses altogether with the main cables, and uses only the branch cables from each seat, though they are lengthened sufficiently to give the necessary near-horizontal pull. Beneath each row of seats, and immediately under the floor, a pair of light-alloy channels extend fore-and-aft over the length of the cabin. These channels are inverted, and their webs are slotted at suitable intervals to accommodate anchorage-hooks at the cable-ends; the hooks are engaged in the slots through holes in the floor. In design each hook to some extent resembles a ship's anchor, though with only one fluke. A small stock passing through the shank also assists in securing an anchor-like holding action in the remainder of the floor should the hook tear out of the slot.

The cables do not run direct from the seats to the anchors, but have a small amount of slack, which is tacked lightly to the floor to enable the carpet to be laid over it. In a crash the tacking breaks and the load comes directly on to the anchored cable. The light-alloy channels are integrated so far as possible with the floor-structure, and provide additional reinforcement.

Clearly, the success of these devices in practice must depend on efficient detail design, and on adequate strength being reconciled with lightness. On the face of it, installation should not present any major difficulty, though it will obviously be very much simpler in the case of an aircraft still in the design stage. Both versions have been provisionally patented.

Mr. Sturge Whiting—whose address is 7a, West Street, Reading, Berks—demonstrated his designs in the B.B.C. television feature, "Inventors' Club," on Wednesday of last week. He informs us that several airline operators who have seen the specifications have shown interest in the idea.

CABIN ATMOSPHERE

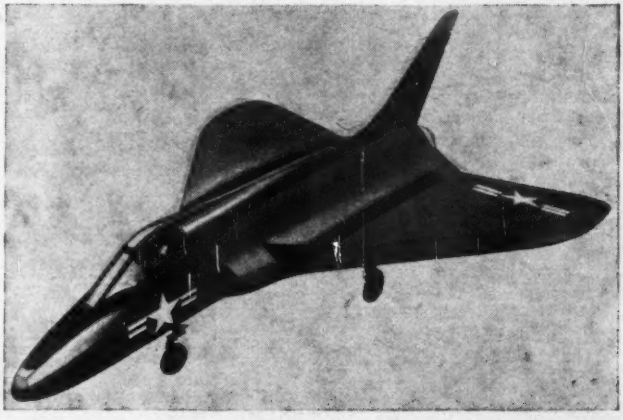
CIVIL aircraft cabin supercharging and conditioning was the subject of a section lecture given in the library of the Royal Aeronautical Society on Tuesday, January 30th, by Mr. W. D. L. Theed, chairman and managing director of Sir George Godfrey and Partners, Ltd.

The main body of the lecture was concerned with an historical survey of the growth of cabin supercharging, with particular reference to the progress brought about in blower design as a result of constant development toward ever-higher performance standards.

Mr. Theed also spoke of the air-cycle-turbine cold air unit, which has recently been modified to employ a radial-flow turbine in place of the axial-flow type previously used. By this means a considerable advantage in performance, size-for-size, has been made possible.

These and other developments in Godfrey equipment will be familiar to readers of *Flight* as a result of the several articles which have successively appeared in these pages during the past ten years.

Following a brief but illuminating discussion, the audience adjourned to Londonderry House for a social continuation of the proceedings.



PIG-TAILED TAR: Absence of horizontal tail-surfaces and a fin of distinctive form characterize the new Douglas XF4D carrier-borne intercepter for the U.S. Navy. Initial tests have already been completed. The new machine is even more unorthodox than the Chance-Vought F7U-1, now in production for similar duties. Two axial-flow turbojets appear to be installed.

Instrument Design

SMITHS

FLUID LEVEL SWITCH

This new Fluid Level Switch has alternative terminal connections for either 'make' or 'break' contacts. It may be fitted on the top, side or bottom of the tank and data sheet C.503 is available giving full technical details and dimensions. This switch is suitable for 5 amp. 24 volts non-inductive load.

SMITHS AIRCRAFT INSTRUMENTS LIMITED

THE AVIATION DIVISION OF S. SMITH & SONS (ENGLAND) LTD

CRICKLEWOOD WORKS · LONDON · NW2 · ENGLAND

Sole Sales Distributors for

KELVIN & HUGHES LTD · BARKINGSIDE AND BASINGSTOKE

MESSIER
UNDERCARRIAGES

Feather-weight Touchdown!

This Messier nosewheel undercarriage is designed to absorb energy on landing at the highest efficiency and, at the same time, allow adequate flexibility when taxying. Powerful steering gear is fitted and shimmy is eliminated by rigidly coupled wheels.

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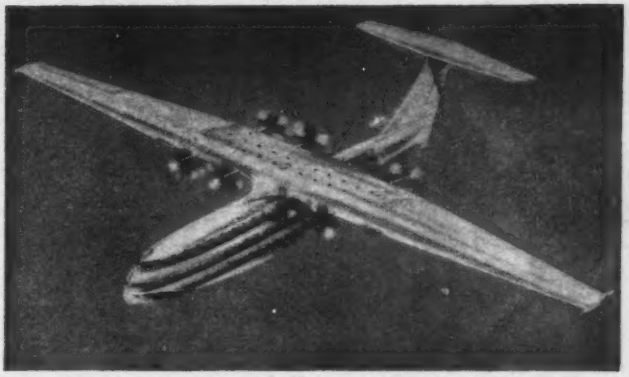
HERE and THERE



TREBLE BUBBLE: Possible appearance of a 500-ton transport flying boat, capable of carrying 300 passengers and 40 tons of freight across the Atlantic, illustrated in a new book, "Wings for Tomorrow", reviewed on page 159.

Brancker Memorial Lecture

MR. PETER MASEFIELD, Chief Executive of B.E.A., will deliver the ninth Brancker Memorial Lecture, at 5.45 p.m. on Monday next, February 12th, at a meeting of the Institute of Transport, in the Jarvis Hall (R.I.B.A.), 66, Portland Place, London, W.1. Discussing *Some Economic Aspects of Civil Aviation*, Mr. Masefield will refer particularly to short-haul operations.

Thunderjets for Europe—

THE first shipment of Republic F-84E Thunderjets is now on its way to Europe, announces the American Department of Defence. Their specific destination is not named, but France is probably the first recipient. Pilots for the F-84s are under training in America and maintenance crews are being instructed by the U.S.A.F. in Germany, which operates a sizable force of Thunderjets.

—and Bearcats for Indo-China

ANOTHER delivery of aircraft under the Mutual Defence Programme took place on February 1st, when the U.S. carrier *Windham Bay* arrived at Saigon with 44 Grumman Bearcat naval fighters for the French forces in Indo-China. Other American aircraft now in action there against the Viet-Minh rebels are 46 Hellcats, 24 Superfortresses and ten Privateers.

Corralled

THE Mustang in which Capt. Charles Blair recently flew from Idlewild to London non-stop (see overleaf) was impounded by the Customs at London Airport after the flight. Capt. Blair flew back to America the day after the trip, making his 401st Atlantic crossing, but was expected to return shortly, captaining a P.A.A. Stratocruiser. According to reports, he hoped to obtain a permit to keep the Mustang, named Excalibur III, in Britain for six months without paying duty of £800—estimated as 20 per cent of its value. Alternatively, he would have to fly the aircraft back to the U.S.A. to avoid forfeiture.

French Air Strength

ACCORDING to a speech by the French Air Minister, M. Maroselli, at Algiers last Sunday, Vampires are being built under licence in France at the rate of six aircraft per month. Production of the Dassault 450 Ouragan fighter had amounted to only one per month, but, by next December, between 30 and 40 a month would be delivered to the French Air Force. The present personnel-strength of the F.A.F. was, he said, about 92,000. M. Maroselli's frank—and, in some respects, disquieting—statement prompts the suggestion that standardization of security, as well as training, methods might further the aims of Western Union.

ON THE D.H. BOARD: Three well-known members of the de Havilland Enterprise who, as we reported last week, have been appointed directors of the parent company. They are, left to right, Mr. A. F. Burke, O.B.E., M.Inst.T., F.R.S.A., managing director of the engine company; Mr. H. Povey, general production manager of the aircraft company; and Mr. C. S. Thom, business manager. Mr. Burke came from B.O.A.C. in 1945; Mr. Povey has been associated with the original D.H. team since 1917; and Mr. Thom joined (from Shell Aviation) in 1928.

Open Those Hangar-doors

"NORMALLY, although they fly every week-end, auxiliary squadrons do only two weeks air flying during the year."—S/L. Paul Richey, misprinted (for "air firing") in last Monday's *Daily Express*.

Atar Turbojet Orders

WITH speedier delivery in mind, the French Air Ministry has decided to divide into two the order placed with S.N.E.C.M.A. for the Atar axial turbojet. It is stated that the first units, to be delivered forthwith, will be rated at 2,400 kg (5,300 lb) thrust, while later versions will produce 2,800 kg (6,170 lb). The weight of these turbojets is given as in the region of 890 kg (1,960 lb), and the diameter is 886 mm (34¾in). By the beginning of next year S.N.E.C.M.A. expect to be delivering in fair numbers the Atar with the higher rating.

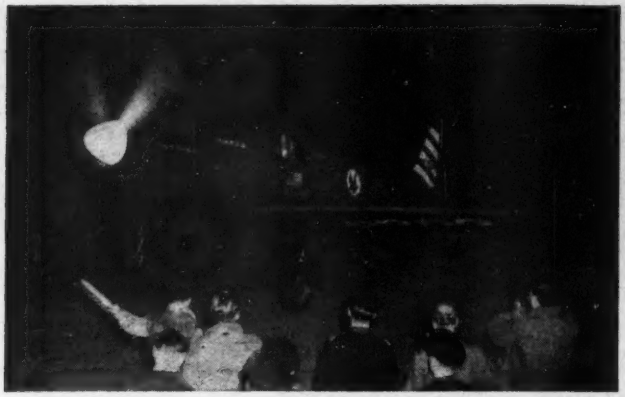
1951 Paris Show

PLANS for the 19th Paris Aero Show, due to take place between June 15th and July 1st, are well in hand. Arrangements will be similar to those in recent years: light and medium aircraft are to be exhibited in the Grand Palais, together with power units and all kinds of equipment; and heavy aircraft will be parked, and in some cases demonstrated, at Le Bourget, where there will be a special enclosure, from June 22nd to July 1st.

As a culmination to the Paris Show, on July 1st at Le Bourget, there are to be special demonstrations of the most recent aircraft of several nationalities and formation displays by units from the French, British and United States air forces.

Princesses as Troop-carriers

IN the House of Commons last week, Mr. Beswick, Parliamentary Secretary to the Ministry of Civil Aviation, stated that the future of the Saunders-Roe Princess flying-boats was being reviewed in relation to the rearmament programme. Surgeon Lt.-Cdr. Bennett asked: "Is it not a fact that five or six aircraft of this type can carry as many troops as the *Queen Mary* or *Queen Elizabeth* without the construction of any docks or runways whatever?" He asked for an assurance that prejudice "in high places" against flying-boats would not blind the Government to their possibilities. The question raised, replied Mr.



TRANSATLANTIC MUSTANG: Seen taxying in at London Airport after a 7hr 38min flight from Idlewild is "Excalibur III," a North American F-51C Mustang modified to hold 865 gallons of fuel in the internal tanks. The pilot (above) was Capt. Charles Blair of P.A.A. Comment on the flight appears below.

HERE AND THERE . . .

Beswick, was being carefully studied at the moment; there was no prejudice against flying-boats.

New Jet Bomber

THE decision revealed by the Prime Minister last week to place first orders for a new British four-jet bomber is described by the S.B.A.C. as a tribute to the skill of British manufacturers, since production has been ordered "off the drawing board." No information may be published concerning any British jet bomber other than the Canberra, but foreign reports have mentioned jet-bomber projects by four companies responsible for bombers during the last war: Vickers, Handley Page, Short and Avro. The three last named, incidentally, are to build the Canberra under licence.

Allison T-40s Ordered

FIRST production contract to be placed for an American turboprop is announced by the Allison Division of the General Motors Corporation. The unit concerned is the T-40, as fitted in the Convair XP5Y flying-boat and Douglas XA2D Skyshark strike aircraft. The order, for an unspecified number of T-40s, has been placed by the U.S. Navy. Delivering 5,500 h.p., the T-40 is a twin version of the Allison 501, two of which have been experimentally installed in a Convair 240—America's first gas-turbine-powered civil aircraft.

Missile Mission

NOW in Australia are Sir Harry Garner, Chief Scientist to the Ministry of Supply, and Air Chief Marshal Sir Alec Coryton, Chief Executive (Guided Weapons). They left London Airport for Sydney by B.O.A.C. Constellation on February 1st. Much of their visit, lasting about a month, will doubtless be spent at the rocket range at Woomera, Western Australia; activities there include flight-testing of the Commonwealth's first jet aircraft, a piloted prototype of a pilotless target designed for the Ministry of Supply.

Films Worth Seeing

AT 6 p.m. on March 17th, in the Central Technical College, Birmingham, the British Interplanetary Society is to show four films—on the German A4 rocket; high-altitude and missile research, both at the Johns Hopkins University; and the Palomar observatory. On March 24th, at 10.30 a.m. and 6 p.m., the programme is to be repeated at the Science Museum lecture theatre, South Kensington, though in this case a film on rocket instrumentation will replace the A4 film. Admission is free to non-members on application (with s.a.e.) to the hon. secretary of the Society, at 157, Friary Road, London, S.E.15.

Record Unobserved

IN the Merlin-powered Mustang pictured above, Capt. Charles Blair flew from New York to London on January 31st in 7hr 48min—an average speed of 450 m.p.h. He was assisted for part of the journey by tailwinds of up to 130 m.p.h. and reached a maximum height of 37,000ft.

Capt. Blair, a 41-year-old Pan American Airways pilot, has 17,500 flying hours and 400 Atlantic crossings to his credit. The Mustang, which he bought at a reported cost of $25,000, carried sufficient fuel in its internal tanks for a range of 5,000 miles.

All credit is due to Capt. Blair for his achievement; but unfortunately the flight was not observed by official representatives of the F.A.I. and cannot be claimed as an official record. This requirement could have been met at a small fraction of the cost of the flight and would have provided a long-overdue replacement for the existing New York-London record of 20hr 29min, set up by a Lockheed Electra in 1937.

NEWS IN BRIEF

A CONFERENCE on "The Use of the Film in Training and Industry" is being held at St. Annes-on-Sea from March 31st to April 1st by the Scientific Film Association. Details are obtainable from the S.F.A. at 4, Great Russell Street, London, W.C.1.

* * *

Mr. W. E. A. Redfearn, a special director of English Steel Corporation, Ltd., has been elected chairman of the Alloy Steels Association in succession to the late Maj. Guy S. Newton. Mr. Redfearn is also president of the National Association of Drop Forgers and Stampers.

* * *

The Anglo-American Oil Co., Ltd., announce that Mr. D. A. C. Dewdney, since 1949 research manager of the Esso Development Co., has been appointed co-ordinator of refinery operations. During the war Mr. Dewdney served, with the rank of wing commander, in the Directorate of Bomber Operations, Air Ministry.

* * *

In a new brochure, *Elastometric Engineering Examples*, the Andre Rubber Co., Ltd., Kingston By-pass, Surbiton, Surrey, illustrate their work in rubber-to-metal bonding, rubber moulding, and rubber-coating of metal components. Engine mountings, intake-guards and a rubber-covered airscrew blade are among the examples of aircraft fittings included in a long series of large and finely reproduced photographs.

Mr. R. K. Spencer has been appointed assistant chief engineer of E. K. Cole, Ltd., makers of Ekco radio and allied equipment.

* * *

Tropal plastic-based aluminium protective coating, a heat-resistant and corrosion-proof finish with a wide variety of industrial uses, is described in literature from Corrosion, Ltd., Warsash, Hants.

* * *

Chamberlain Industries, Ltd., Staffa Road, London, E.10, publish details of a general-purpose bench type arbor press; of the hand-operated hydraulic type, it exerts a five-ton load.

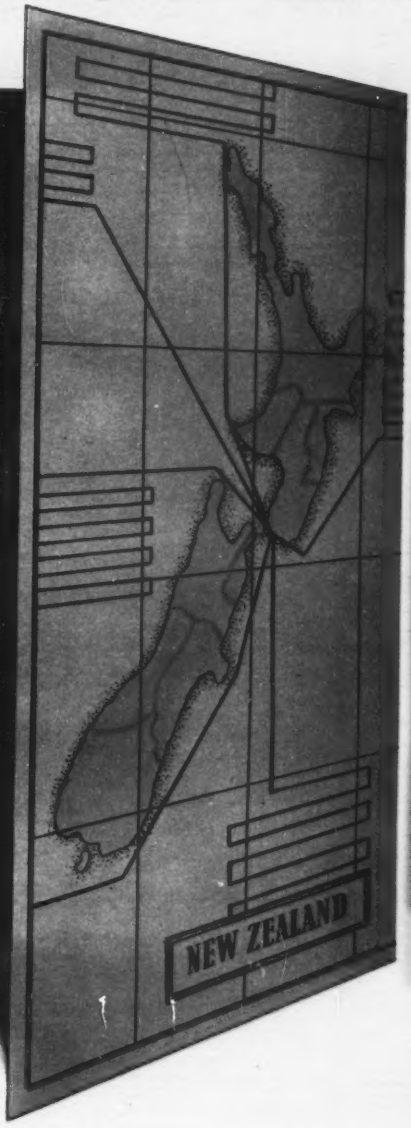
* * *

The Mond Nickel Co., Ltd., announces that Mr. L. H. Cooper has been appointed chairman and Mr. L. K. Brindley managing director. Mr. G. Archer and Mr. A. Parker Hague continue as directors, and Mr. I. A. Bailey, Dr. L. B. Pfeil and Dr. A. G. Ramsay have also been appointed to the board.

* * *

The Petroleum Information Bureau, 29, New Bond Street, London, W.1, has engaged a leading designer to prepare a pictorial exhibition depicting the activities involved in the discovery, refining and distribution of oil and its products. Intended for display in works training centres, canteens, etc., the panels require about 20ft of wall space and are available free of charge for exhibition at appropriate periods.

Command of the Sea



Maritime Reconnaissance Bomber is the title for an aircraft which must be capable of fulfilling a variety of roles. That is why Coastal Command Royal Air Force, is now being re-equipped with Avro Shackletons, specially designed and fully equipped for tasks as arduous as any in the history of flying. The provision of four engines, regarded as an essential, inspires confidence in the crew, whose comfort and requirements have been main considerations in the layout of its spacious interior. With the most up-to-date radio and radar, with its powerful offensive armament and low level manoeuvrability coupled with its ability to carry large and varied loads to extreme ranges, the Avro Shackleton is a formidable attacker.

Shackleton

A V ROE & CO LTD MANCHESTER *Member of the Hawker Siddeley Group*

Venom night fighter

de Havilland Ghost engine

Daylight interception standards
for defence by night

DE HAVILLAND

AIRCRAFT

ENGINES

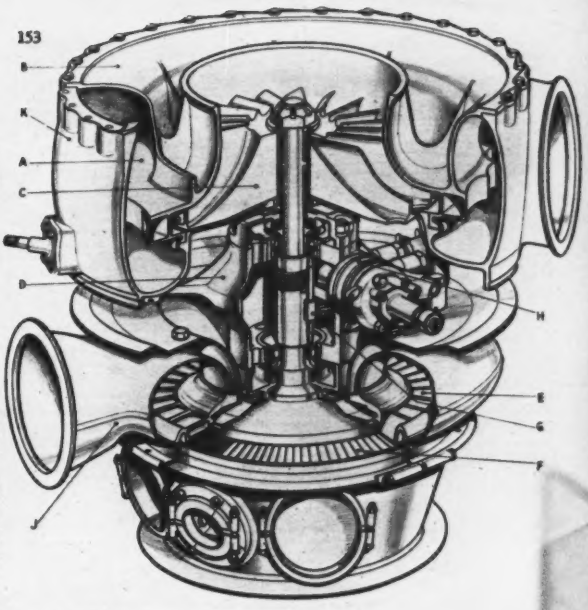
TURBO-SUPERCHARGING

Latest American Variant of Exhaust Turbo-blower : Impressive Performance

OWING to supersession by the turbojet and turboprop, the aircraft piston engine in this country has been relegated to obsolescence—at least in the higher power ranges. In the United States, however, development of the more powerful reciprocating types is still being vigorously pursued. That this should be so is understandable in view of the relative backwardness of American engine manufacturers in developing turboprops, and it is obvious that until such time as turboprops are able to take over the duty performed by the large piston engines, the latter are assured of continued demand.

A recent development by the General Electric Company in the exhaust turbo-supercharger used with the Pratt and Whitney R-4360 series Wasp Major engines makes possible a step-up in all-round performance which bids fair to make these excellent piston engines attractive, *vis-à-vis* comparable turboprops, for an even longer period than might have otherwise been the case. Considering their background of practical experience with exhaust gas turbines for supercharger drive, it is somewhat astonishing that the U.S. did not rapidly match British technological advance in the gas turbine prime-mover field. It was in 1901 that the late Dr. Sanford Moss, then a graduate student at Cornell University, started to work on a gas turbine. The project aroused the interest of the General Electric Company, and Moss was commissioned by the company to design and develop a gas turbine for them. This he succeeded in doing by 1907, but as the efficiency of the unit was only about 3 per cent, the company abandoned attempts at development.

The turbo-supercharger as such was first applied to aircraft engines by August Rateau in 1916; in the following year the American Army became interested in this French design, and persuaded the General Electric Company to develop a turbo-supercharger; naturally enough the work



A = diffuser
B = compressor-casing (rear)
C = impeller
D = bearing- and pump-casing
E = entry nozzles
F = turbine
G = oil jet
H = oil pump
J = nozzle-box
K = compressor-casing (front)

Fig. 1. Design details of the BH 4 turbo-supercharger. The basic elements of this unit are essentially similar to those of the later type CH 9.

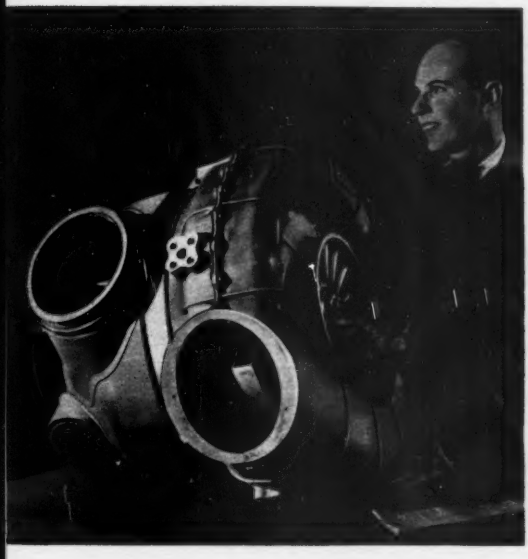
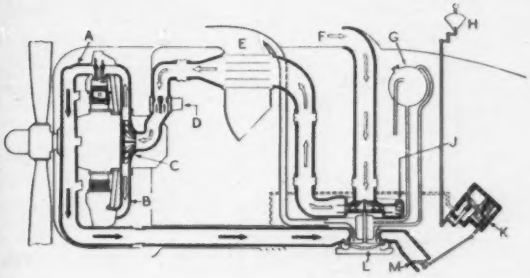


Fig. 2. As may here be seen, the CH 9 turbo-blower although neat and compact in design is not small.

Fig. 3. Schematic diagram of BH 4/engine installation with internal (mixture distributor) supercharger and intercooler.

A = exhaust manifold
B = intake manifold
C = internal (mixture distributor) supercharger
D = carburettor
E = intercooler
F = ram air-intake
G = oil tank
H = boost control
J = turbo-blower diffuser
K = regulator
L = turbo-supercharger
M = waste-gate



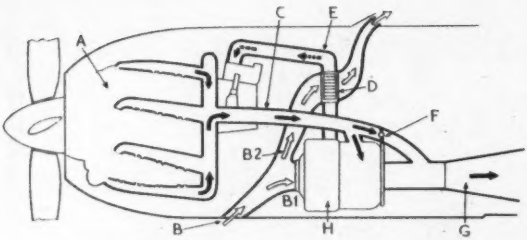


Fig. 4. Diagram of air and gas flow-paths in R-4360C Wasp Major power-plant with CH 9 turbo-blower. Direct fuel injection is used, and there is no mechanical connection between engine and supercharger.

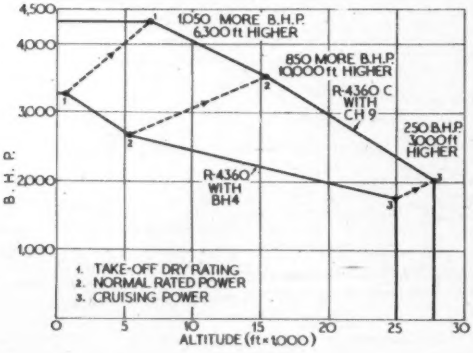
TURBO-SUPERCHARGING . . .

was put under the direction of Sanford Moss. The G.E. turbo was submitted for test in 1918 and so was inaugurated a continuous progress of development which extends to the present day and may well continue for some time to come. It is indisputable that this is in no small measure due to the fact that, until 1937, when he retired, the work was continously directed by Dr. Sanford Moss, but there is also little doubt that some advantage accrued as a result of the U.S. Army paying the entire costs of the development from 1919 until a few years ago.

Whilst briefly reviewing the historical background of the exhaust turbo-blower, it is worth while to note that in Britain, a turbo-supercharger was designed during the 1914-18 war by James E. Ellor, of the Royal Aircraft Factory —later the R.A.E. Development with Ellor's turbo-blower was carried forward energetically at the R.A.E. during the first half of the 1920s, but, for a variety of reasons, the focus of attention was shifted at about 1926-27 to mechanically driven superchargers, and the exhaust turbo-blower was shelved. James Ellor, undoubtedly the most brilliant mind in the supercharging field in this country, left the R.A.E. in 1927 and went to Rolls-Royce.

To revert, however, to the G.E. turbo-blower, this has been developed to supersede the type BH 4 (Fig. 1) which, on the Pratt and Whitney Wasp Major, has a background of something approaching 200,000 hours of operation on Stratocruisers alone. In mechanical design, the new unit—the CH 9—is essentially similar to the BH 4, but engine modifications necessary for the new installation have resulted in the use of a new series number, and the engine is designated as the Wasp Major R-4360C. Test-bench work has shown that a take-off power increase of 32 per cent and a reduction in specific fuel consumption of 20 per cent is given by the new development by comparison with the R-4360 engine with BH 4 turbo-supercharger. On the basis of this performance, General Electric asserts that the new power-plant will enable a large transport (presumably such as the Stratocruiser) to fly non-stop between New York and London and to carry 75 per cent more payload on other long flights as, for example, from Paris to Dakar, or from San Francisco to Honolulu.

Fig. 5. Comparative chart showing gain in power and altitude performance given by the CH 9-supercharged engine relative to the standard R-4360 Wasp Major equipped with BH 4 turbo-blower.



The new supercharger (Fig. 2) was designed for application to transport type aircraft for which take-off power requirements are limited to 5,000-7,000ft altitude, and for which maximum cruising power is not used above 25,000ft. It is claimed, however, that in conjunction with booster turbos the new unit can be applied to military aircraft for operation at considerably greater altitudes. The most important differences between the BH 4 installation (Fig. 3) and the new power-plant (Fig. 4) are the elimination of the intergral mechanically-driven supercharger and the carburettor in the former in favour of the direct fuel injection and no secondary (internal) supercharger in the latter. Normally the mechanically-driven supercharger, as used in the BH 4 installation, absorbs 500 h.p. from the crankshaft, and only a small part of the available exhaust energy is used because, at cruising conditions, the supercharger serves as a medium for fuel distribution to the cylinders, and the turbo-blower airflow is limited. By virtue of its use of direct fuel injection, the CH 9 installation is able to employ a large part of the exhaust energy to provide full manifold pressure. Thus, most of the 500 h.p. which would be absorbed in driving a mechanically coupled supercharger remains in the crankshaft and is therefore available for propelling the aircraft. The CH 9 is somewhat larger than the BH 4 in having a maximum diameter of about 28in, a maximum length of 26½in, and a weight, with accessories, of 300 lb. It consists, essentially, of a single-stage centrifugal-flow compressor, driven by a single-stage axial-flow exhaust-gas turbine. The compressor and turbine are mounted on the same shaft and are assembled, together with an oil pump and bearings, in relative positions in the casing so that their openings will align with the appropriate ducts and pipelines of the particular power-plant installation.

The basic units of an installation, as may be seen from Fig. 4, are the engine, the supercharger, and an external aftercooler. Air enters the ramming intake, and is introduced into the eye of the supercharger compressor; a portion of the entrained air is diverted across the aftercooler, whence it escapes to atmosphere. The main engine air is compressed in the supercharger to between 25 and 35 lb/sq in, and is then discharged through the aftercooler, which removes the heat of compression and, in fact, reduces the temperature of the air by more than 65 per cent. From the aftercooler the air enters the engine intake system at a temperature of less than 38 deg C. The increase in volumetric efficiency thus gained is claimed to make possible a specific fuel consumption as low as 0.36 lb/b.h.p./hr.

Simplification, enhanced reliability, and a reduction in maintenance is implicit in the absence of mechanical connection between engine and supercharger. It is claimed that the CH 9 can compress air at mass-flows up to 350 lb/min, and can provide aircraft cabin pressurization at altitudes up to 30,000ft. The chart shown in Fig. 5 indicates the all-round gain in power and altitude performance of the R-4360C engine equipped with the new turbo-blower as compared with the BH 4 turbo-blown R-4360 engine incorporating the built-in mechanically driven supercharger. The CH 9 turbine has a maximum continuous speed rating of 18,000 r.p.m., and exhaust gas entering the turbine installation at a maximum continuous temperature of 955 deg C is discharged at a maximum continuous temperature of 233 deg C.

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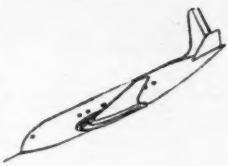

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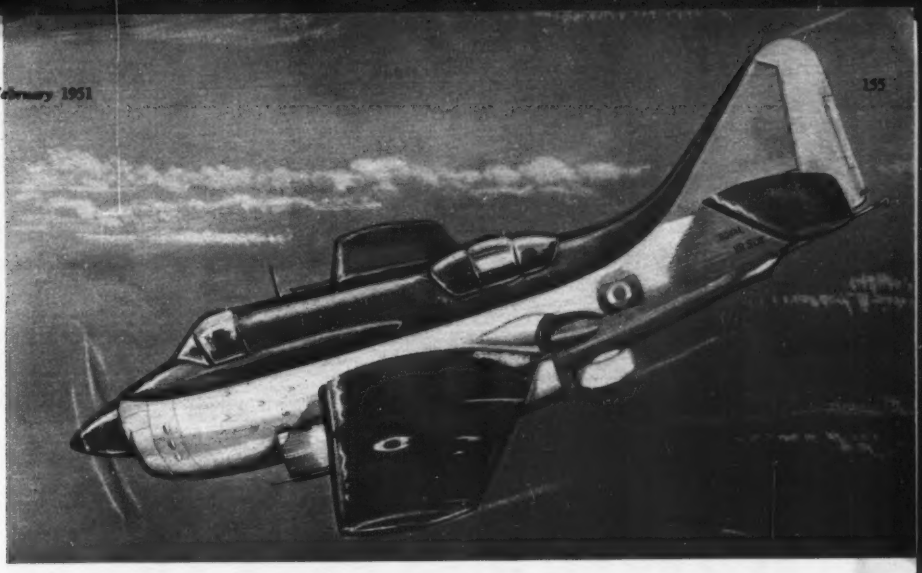
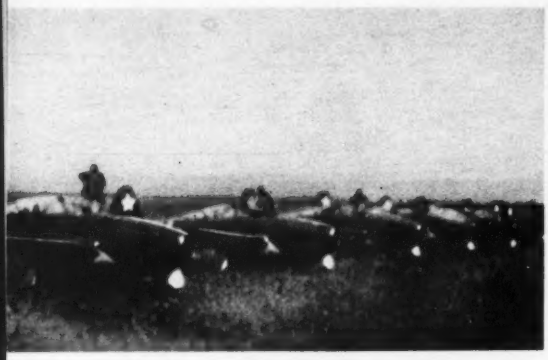


The Navy's New Anti-submarine Aircraft

THE formal announcement of an order placed by the Ministry of Supply on behalf of the Admiralty for a "substantial number" of Fairey 17 carrier-borne anti-submarine aircraft is certainly one of the most welcome items of news released this year. Fears of a protracted production period are, to a large extent, allayed by the knowledge that the new Fairey patented system of envelope jigging will be utilized. Commensurate production of the Armstrong Siddeley Double Mamba turboprop, round which the "17" was designed, is, of course, a prerequisite; but excellent reports of Mamba development in recent months leaves little ground for uneasiness on this score.

Photographs on this page show one of the Fairey 17 prototypes during recent deck trials. It will be noted that wing "fences" have been installed slightly outboard of the second wing-folding point. The drawing at the head of the page illustrates a revised cockpit arrangement, likely to be adopted for production aircraft.

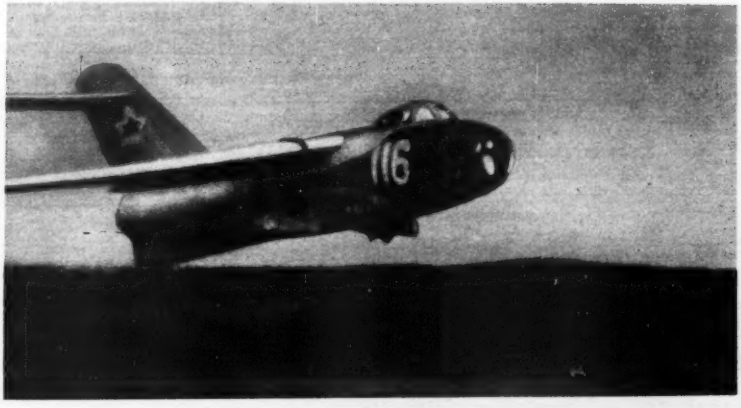
The "17" is so far un-named. "Fleetwing," "Frigate" and "Fathomer" have obvious claims to consideration.



(Left) A line-up of Yak-15 single-jet fighters. Together with others on these pages, this picture is reproduced through the courtesy of Gaumont-British News.

New Angles and More Technical Evidence from Films : Strikingly Modern Swept-wing Designs, and the Obsolescent Straight-wing Yak-15

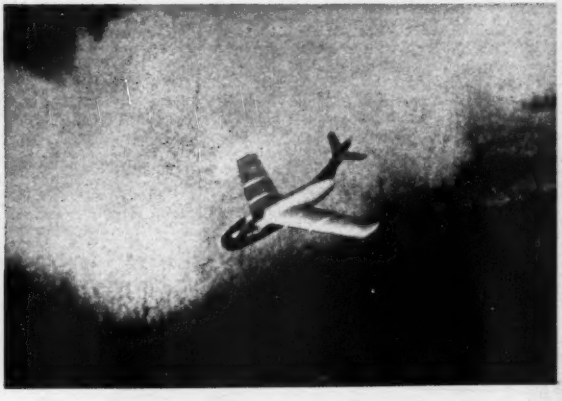
Russian Jet Fighters

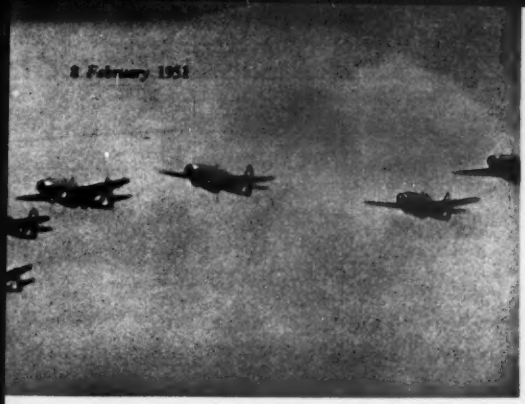


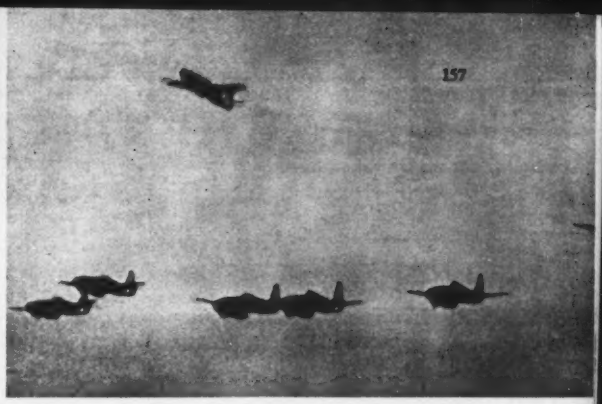
A revealing take-off shot of a Lavochkin fighter, believed to be designated La-17. This type strongly resembles the Mig-15, but the wing is set higher. It will be seen that the wheels retract into the circular-section fuselage.

A probable La-17, showing the wing form to advantage.

A Mig-15(?) with double boundary-layer fences on the swept wing.







Unlike the newer Russian fighters, these Yak-15s are easily identified. (Right) A Yak-15 breaks formation. The type is highly manœuvrable.

TWO NOTABLE BOOKS

"Wings for To-morrow," by J. W. R. Taylor and M. F. Allward. Ian Allan, Ltd., 282, Vauxhall Bridge Road, London, S.W.1. Illustrated. Price 7s 6d.

HAVING studied the case for the flying-boat put by Messrs. John W. R. Taylor and Maurice F. Allward in this book, published last week, it is easy to understand Lord Brabazon's feelings as expressed in his characteristically Brabazonian foreword. "Speaking on behalf of the great Brabazon Committee," he writes, "I have always felt a little guilty that we did not see our way to recommend the building of new 'boats.' I have always been surprised, considering the popularity of flying-boats, that the Committee was not vigorously attacked for its sins of omission. The facts are, however, that we did all we could, but our terms of reference were to express 'users' requirements' as to future types, and at that time we could not get those in charge of the operation of fleets of aircraft to demand them. I thought then it was a mistake; I am sure of it now."

Lord Brabazon gives praise to the Ministry of Supply for having the imagination and faith in flying-boats to have ordered the Princess. It is these same qualities of imagination and faith which for some forty years have spurred British designers to build the world's finest marine aircraft. Many of these, for various reasons, were little known in their day and are now almost forgotten; the more credit is due, therefore, to Messrs. Taylor and Allward for recording their characteristics for posterity, together with those of their more renowned sisters.

Wings for To-morrow, indeed, is not only a powerful vindication of the flying-boat, but a rich source of delight to the student and collector. Photographs are reproduced of such *rara aves* as the Farnborough-built P.E.1 and the Parnall Prawn (powered with a spare auxiliary engine from the airship R.101). From an abundance of anecdotes it is difficult to select the most appealing, but perhaps it is that concerning the Sopwith Bat Boat, the hull of which was the work of that great craftsman Sam Saunders of Cowes. Piloted by Harry Hawker, this wonderful old aircraft won the Mortimer Singer prize in 1913. It is related how the Prize flights were between a buoy moored in the Solent and a meadow near the present site of Hamble airfield. The "official observer" was the pioneer Naval airman Lt. Spenser-Grey, who decided to make his chore worth while by doubling as passenger —a rôle that proved to be no sinecure, as the retractable wheels stolidly refused to drop under their own weight when released after each take-off from the water. Consequently, the "official observer" had to stand up, put one leg over the side of the hull and kick the wheels down in flight. Fortunately, in those days nobody worried much about official observers lending a hand (or foot) to competitors, and so Hawker, Sopwith and the Bat Boat carried off the £500 prize-money. In its day the Bat Boat (which incidentally, had the distinction of being used by both British and German Naval Air Services during the Great War) was quite as remarkable as the Saunders-Roe Princess, the first of which is shortly to receive its engines at Cowes.

The magnificence and potentialities of the turboprop Princess and pure-jet Duchess are given due place in this wholly commendable book—a work which seems assured of an enduring place in aeronautical literature. The authors' declared object was to stoke the fires of controversy and to ensure that people talk about flying-boats, even if they cannot fly in them. We have no doubt that this object will be attained.

"Air Power—Key to Survival," by Alexander P. de Seversky. Simon and Schuster Inc., 1230 Sixth Avenue, New York 20, U.S.A. Illustrated. $3.50.

THE whole thesis of this remarkable book is summed up in its five-word title. "Only air power," claims Major Seversky, "can deter Soviet aggression, through fear of swift and devastating retaliation"; and only air power on an immense scale could enable America to survive a third World War.

Few who read the book will dispute its basic reasoning. We won the last war because "we buried our enemies under an avalanche of industrial output," and it is easy to delude ourselves into thinking that we can do the same again. Unfortunately, explains Seversky, "A titanic mass of weapons calls for a titanic mass of men to wield them" and, whereas in World War II "we were able to mobilize almost half the human race—about a billion people—against the quite limited manpower of Germany and Japan . . . . in any genuine world war to-morrow the billion men will be on the enemy's side."

We can never, therefore, expect to match Russian land power, even given superior weapons. Furthermore, "even if we could generate armies of the necessary size, we could not land them or transport them to the battlefields before the enemy was denuded of his [submarine and] air strength; and when he is thus denuded, there is no longer any need for mile-by-mile surface struggle." With the Russian homeland laid bare to systematic annihilation, it would no longer be necessary to liberate, and destroy in the process, countries which had been occupied by Soviet troops. We had an example of this in World War II, when "The Navy had the transport to make the invasion of Japan possible, the ground forces had the power to make it successful, and the B-29 made it unnecessary."

But Major Seversky does not believe that the Pacific campaign holds any tactical lessons for the future. On the contrary, he emphasizes that the whole object of that grim, island-hopping struggle was to seize bases from which a final all-out onslaught could be made against Japan itself, whereas the Convair B-36 bomber could attack Russia direct from bases inside America. Consequently, Seversky urges that at least two-thirds of America's military budget must be devoted to the building-up of a vast force of B-36s, although he has no illusions about this aircraft's limitations at its present stage of development.

Ultimately, he predicts, it will give way to the giant "flying battleship," in which the crew will fight from a small, heavily-armoured and pressurized compartment in the heart of the aircraft, which will be navigated and defended automatically by radar. Even its warload will be revolutionary for, instead of bombs, it will carry "in effect, V.2 missiles fired downward"; yet no aspect of this super-bomber is too fantastic to be credible even by present-day standards, and Seversky puts forward powerful arguments in favour of making it water-based.

It is easy to criticize some details of *Air Power—Key to Survival*. For example, English eyes boggle at the sight of such misnomers as "Gloucester Meteor" and "Buscom Downs," and one wishes that the Chinese in Korea had read that "armies are helpless under hostile skies." It is less easy—in fact, downright foolish—to dismiss Major Seversky's main argument without careful consideration, remembering that Winston Churchill stated on March 31st, 1949, that "Air mastery is to-day the supreme expression of military power, and fleets and armies, however necessary, must accept a subordinate rank."

NOT UNFAIR TO VETERANS

Methods of Demonstrating Old-time Aircraft at Flying Displays : An Operator's Explanation

By A. Cdre. A. H. WHEELER, O.B.E.

The Sopwith Pup of World War I is, of course, the most nimble of the veterans under discussion. It is flown by the author of this article.

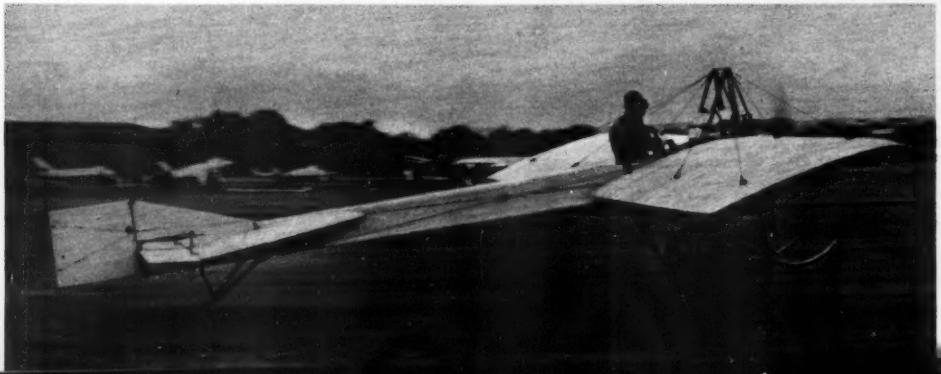
DEMONSTRATIONS of pre-1914 aircraft have been an unfailingly popular feature of a number of flying displays during recent years. A few weeks ago, under the title "Unfair to Veterans," a contributor suggested that the modest evolutions which these machines execute do not reflect their true capabilities in the light of their known performances when they were in their prime. In this article—which reaches us from Cyprus, where he is at present serving—A. Cdre. Wheeler explains some of the considerations that govern the conditions under which veterans are demonstrated. By virtue of his association with the Shuttleworth Trust, which owns most of the existing airworthy veterans, he is well qualified to write on the subject.

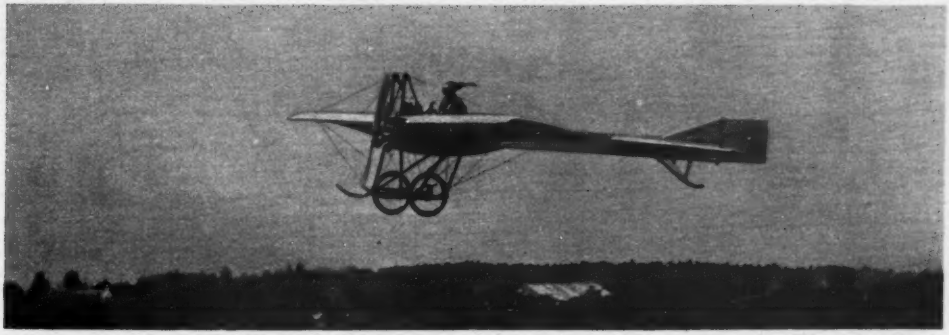
IN an article in the December 21st issue of *Flight*, Mr. A. H. Curtis gave his views on methods of flying veteran aircraft at present-day displays. We who operate several of them for the Shuttleworth Trust also want to be fair to these aircraft, but Mr. Curtis, it seems, does not like the middle course we aim at. He asks, in effect, for one of two extremes—either that they should metaphorically (and probably literally) be flown to bits, or that they should, so to speak, be put in a glass case. We try to reconcile these extremes. We want to show them off at their best, but we also feel an obligation to ensure that they are preserved and kept flying for the interest and education of generations to come. Our aim at present is to fly the veterans up to the reasonable limits of their performance and manœuvrability but to avoid any risk either to them or to the crowds who watch them. In this policy I believe we have the support of the authorities concerned. It is only fair to those who fly the veterans and adhere to the limitations I personally imposed to put the other side of the case as we see it. Let me say at once that none of the pilots has been worried by the absence of parachutes or modern instruments. Nor are they unskilled. They do, however, all have a proper respect for the piece of mechanical history which they have in their hands.

The top limit of their performance and manœuvrability is well illustrated by Mr. Curtis, who quotes interesting historical data on the subject; but he quotes it in a way which could be misleading. For instance, the Bleriot XI with the fan-type Anzani engine which we have is certainly almost identical with the machine in which Louis Bleriot flew the Channel. It is therefore probably the most interesting type in that range. It is true that Bleriot achieved an estimated height (no instruments) of 200 feet on the way over, but the cliffs he started from were 180 feet high. If he did gain the extra 20 feet it was still not an appreciably better rate of climb than the Shuttleworth Bleriot managed last summer. Perhaps Bleriot could have got higher, particularly if the rain-storm which cooled his engine in the nick of time had persisted; but, in fact, after 37 minutes' flying he was unable to get over the Dover Cliffs—no higher than his starting point—and had to fly along them to find the valley in which he landed. It seems, therefore, that the Bleriot XI to-day puts up a performance at least good enough to demonstrate how it used to fly in the practised and able hands of its designer.

The Deperdussin has certainly some excellent flights to its credit, not only in the hands of Mr. Jimmie Edmunds but also when it was flown by the late Richard Shuttleworth; on one occasion, in 1939, he got it up to 1,200 feet. But it climbs slowly, and even completing a circuit takes longer than can usually be allowed at a public display. The Dep, like the Bleriot, does not like modern slipstreams and at Beaulieu in 1947, when it did a circuit during the Battle of Britain Display, it took an extremely poor view of the twin jet-streams from a Meteor which had passed that way a few minutes before. Let it be remembered that both the Bleriot and the Dep are flown to-day in weather conditions which, in the old days, would have kept them in their hangars. It is true that the Dep, on one day of the R.A.F. Display, failed to fly, but this was due to a sparking plug oiling up so that one out of its three cylinders was cut out. No one can complain that that was unrepresentative of the old days! Given a still, cool day with the proverbial cigarette smoke going (nearly) straight up, given an airfield cleared of power-

The 1910 Shuttleworth Deperdussin was demonstrated at last year's Royal Air Force Display at Farnborough by W/C. T. D. Colnan. "Flight" photograph.





"The Deperdussin . . . . climbs slowly, and even completing a circuit takes longer than can usually be allowed at a public display."
R.A.F. official photograph

ful slipstreams, and given (say) 15 minutes in which to demonstrate itself, the Dep can still do a creditable circuit.

The Pup does not come in for much criticism from Mr. Curtis, although the commentator is arraigned for drawing dramatic attention to the fact that it is going to loop. But, after all, it was a display and commentators are supposed to work up a reasonable enthusiasm in the crowd. No one would really like a commentator to drawl out, in a flat monotone, "There's a Pup taking off. I suppose he'll do the usual turns and the same old loop. Nothing in it; they used to do much more than that in 1917. If it can't do more than that it ought to be put in a museum." Anyone who has heard the commentators at the Cleveland Air Races in America, making much more out of much less, might stand amazed at our moderation. We believe that all those who come to an air display, from the oldest "old-timer" to the youngest cadet, would rather see the veterans in the air than on the ground.

Whenever we demonstrate the veterans we always try to arrange for the commentators to give the public a serious account of the history and achievements of the type flying, and this has been done within the limits of the time allowed. We have avoided any suggestion of the comic when showing veterans, since we have too much respect for them. We can't help the fact that they look unusual to-day; if they didn't there would be no point in showing them.

At public displays now all events must keep exactly within their allotted time. At the R.A.F. Display a period of ten minutes was allowed, which was extremely generous considering the number and importance of all the other events. To the minute, therefore, all the veteran engines had to be started up—how many of the early aviators could have guaranteed that? There was an ever-freshening wind each day which, in their heyday, would have grounded most of them. We had to plan avoidance of slipstreams and jet-streams undreamed of when the veterans were designed. Finally, and most important, the airfield had to be clear exactly on time for the next aircraft—a Meteor—to take off, and the Bleriot needed 4½ minutes to fly the length of the runway! If the performance of the veterans, under these conditions, came below what they once achieved under ideal conditions of weather and with plenty of time to try and try again, it was not very surprising—or, one feels, particularly sericus.

So in future, unless persuaded or convinced of any better course, we will pursue the middle one, and the veterans, sometimes short in wind, inevitably old in limb, will continue to fly as safely as they may for the interest of future generations who grow up and wonder how the early aircraft used to look when they were in the air. If they want to know about the outside limits of their performance and manœuvrability—to see vivacious veterans, bunting Bleriots or disintegrating Deps—it is for a film company to gratify their wish, not the Shuttleworth Trust.

We look upon veterans with the same kindly respect as that with which one regards Chelsea Pensioners or other aged warriors who pass their declining years in honourable retirement. When we meet them we feel they have earned a quiet though still gently active old age. We don't feel that they ought to be either in a glass case—or Korea!

U.S.A.F. "ARCTIC SURVIVAL TEST"

A FIELD-TEST has been carried out in Alaska in an attempt to establish the requirements for an all-purpose survival-ration. It was conducted at Blair Lake, some fifty miles south-east of Ladd Air Force Base, Fairbanks, by a group of scientists and fourteen volunteers from the U.S. Air Force. In temperatures ranging from 20 to 30 degrees below zero, the test subjects spent ten days under canvas, living on a ration which contained only 475 calories, or the equivalent of two candy bars a day.

Writing in the *Journal of the Arctic Institute of North America*, Kaare Rodahl says the experiment formed the conclusion of a long series of studies which has been carried out during the past few years by the Aero Medical Laboratory, Wright-Patterson Air Force Base, in conjunction with the Arctic Aero-medical Laboratory in Fairbanks. The experiment was planned in collaboration with Colonel Bollerud, head of the Fairbanks Laboratory, by a staff of five who also experienced all phases of the test themselves.

The experiment began with a four-day "standardization period" at Ladd Air Force Base. The personnel were then flown to Blair Lake by Detachment B of the 10th Rescue Squadron, and their equipment was landed on the lake by glider.

The field test consisted in living on the "trail ration" under simulated emergency conditions. The survival camp was established by the subjects themselves and standard equipment was used. Camp work, ski-ing and snowshoeing involved considerable calorific expenditure during the test, and the weather was at times quite severe, with strong wind and considerable snowfall and cold. In the ten-day period weight-loss up to 14lb per man occurred, but no serious deterioration in morale or in physical condition resulted.

At the end of the ten-day period the personnel were flown out of the area by a variety of aircraft: helicopter, glider, and Cessna, provided by the 10th Rescue Squadron. The test concluded with a four-day recovery phase at Ladd Air Force Base, where the laboratory work was completed.

RUST REMOVAL AND PREVENTION

TWO complementary preparations that should find a number of useful applications are "Aero C" rust solvent and "Metlgard" protective oil. The former is a liquid rust-removing medium which is brushed, sprayed or otherwise applied to corroded surfaces, whereupon the rust or scale is converted into an oily scum that can be easily wiped off. It is also effective for freeing rusted bolts, nuts and other fittings. "Metlgard," applied at the rate of one gallon to 100 sq ft of surface will, it is claimed, effectively prevent any new risk of corrosion. Both these preparations, which are supplied in various quantities from 3-oz samples to 5-gallon cans, are stated to be harmless to either ferrous or non-ferrous metals.

"Metlgard" has M.O.S. approval (R.D. Mat. No. 4089) for corroded aircraft engine cylinder parts before inhibition with D.T.D. 587 or D.T.D. 791 for long-term storage. The makers are Dex Industries, Ltd., Edwin Road, Twickenham, Middlesex.

SEATTLE-TACOMA

Although the main buildings of the new Tacoma Airport at Seattle in Washington State have been open for some eighteen months and are therefore no longer news, they are without doubt among the finest in the world, both from the point of view of appearance and suitability for their work. These photographs and the description will serve to introduce the airport to many readers, and may provide architects with food for thought.

WELL-TRAVELLED visitors to Seattle-Tacoma Airport, Washington, U.S.A., agree that its extremely attractive layout is outstanding among those of all the other great and modern airports of the world. It combines impressive beauty with functional utility.

Though owned and operated by the Port of Seattle, the airport is a product of co-operative effort. The site was selected by the U.S. Civil Aeronautics Authority and purchased in 1942-3 by the Port of Seattle for 660,000 dollars with the help of a grant of 100,000 dollars from the Port of

Three aspects of the airport : top, the approach from the east ; above, the main observation waiting hall ; below, a plan view looking east.

Tacoma, the City of Tacoma, and Pierce County. The total airport investment, including local public funds, federal funds, and private capital, amounts to 11 million dollars.

Initial construction began in 1942, when concrete runways were laid by the Civil Aeronautics Authority (as a part of the overall programme of national defence) after extensive investigations had shown the site to be one of the best fog-free spots in the Seattle-Tacoma area.

Within five months of the airport's inauguration a staff of one thousand was employed and fifteen hundred passengers were being handled daily on sixty scheduled flights.

The administration building was entirely designed by the Port of Seattle engineering staff. It was first opened to the public on July 9th, 1949.

The general building layout is convex, comprising a six-floor central section flanked by three-storey north and south wings swept back at 22½ deg. Generally, the interior of the building forms a unit, with no divisions between wings and central section. The north wing is occupied by ticket counters, shops, offices, and the main dining-room seating approximately 150 persons. The south wing houses offices and the bulk of passenger facilities: coffee shop, cocktail lounge, barber's shop, fully equipped beauty salon, valet service with showers and dressing-rooms, lounges with full-length mirrors for the ladies, and a nursery.

An open observation deck runs across the entire field-side face of the building. Adjoining the eastern or convex side of the building is an underground garage with 23,833 sq ft of floor space and including a fully equipped service station. Here, the round-trip airline passenger may leave his car in storage and pick it up, serviced and washed, upon his return.

Details of constructional materials and furnishings are as follows: Main structure of fireproof, reinforced concrete. West wall of main central section, glass through three floors to provide unobstructed field view. Glass building blocks employed where generous lighting is required, but direct sunlight is too severe. North and south wing walls faced with pre-cast concrete slabs, removable for future expansion.

The spacious booking-hall contains counters for each operating company.

Floors of concrete. Main waiting-room, air-conditioned. Heating, by a combination of steam, hot water, and forced warm air. Three baggage, three freight and three passenger lifts. Baggage transfer, incoming, via elevator from operational area to floor counters; outgoing, via conveyor belt system from counters to operational area. Vehicular traffic approaches or leaves by two semi-circular, inclined ramps passing directly in front of the main lobby and ticket offices.

Concerning runway and apron construction information is as follows: Runway: built at a cost of 4,319,143 dollars. Concrete 6in to 8in thick, 150ft wide. North-south runway 6,100ft long, to be extended to 7,500ft, plus 900ft of graded, compacted over-run. East-west runway 5,000ft; N.E.-S.W. 5,000ft; N.W.-S.E. 5,093ft. Apron: Eight aircraft parking sites, each 150ft in diameter, served by eight loading gates. Space available for eight additional positions. Airfield lighting: flush type on all four runways. High-intensity lighting on instrument runway and approach-line lighting planned.

Radio facilities comprise: R.T. and I.L.S. In addition, G.C.A. and surveillance radar systems are planned.

HELICOPTER RECORDS

F.A.I. Requirements : The Lists as They Stand To-day . . . By H. J. COOPER

THE Fédération Aéronautique Internationale has recognized helicopter records since January 1st, 1924, and the first performance to be confirmed as an official record was made on April 18th of that year. On April 14th the Frenchman, Etienne Oemichen, piloting a helicopter of his own design, had flown 360 metres, and three days later he beat this with a flight of 525 metres. On the following day the Marchese Pateras Pescara, the Italian designer, improved on these figures by flying 736 metres (at a height of about six feet); this flight became the first helicopter record. It was accredited to France, as that was where the flight was made; to-day records go to the nationality of the pilot.

Oemichen set up two height records in 1924 which were officially confirmed. The first was with 100 kg payload and the second with 200 kg. Both flights were made at Arbouans (Doubs) in a helicopter designed by himself and fitted with a 180 h.p. Le Rhône engine. The figure for each of these height records was one metre! From time to time the F.A.I., at its annual conferences, modifies the conditions relating to record attempts to render them more indicative of practical performance, and both of these height-record categories were abandoned in 1926.

After the first three helicopter records no more were confirmed until 1930, although rotating-wing experiments continued in most countries and performances slowly improved. In that year the Italian d'Ascanio helicopter set up the first duration record and the first height record under the amended conditions; it also improved upon Pescara's distance record, raising the figure to 1,078 metres.

Another five years passed before any more records were confirmed, and towards the end of 1935 the French Bréguet-Dorand helicopter set up the first closed-circuit distance record with a flight of 500 metres. The following year this aircraft established the first helicopter speed record at 44.69 km/hr; increased the closed-circuit distance to 44 km; and raised the height record to 158 metres.

Meanwhile, Professor Focke was developing his helicopters in Germany, and in June, 1937, went all out with the Fw 61 to capture the records for speed, duration, straight-line distance, closed-circuit distance, and height, all of which showed great improvement over the existing figures. The height record, in particular, was raised to 2,439 metres—over 15 times higher than the record set up nine months earlier. The speed record, too, was raised to nearly three times the figure at which it had stood seven months before. At the outbreak of war in 1939, Germany had improved upon her performances for duration, straight-line distance,

The Fairey Gyrodyne holds the British national helicopter speed record at 124.3 m.p.h. The attempt was made at White Waltham airfield.

HELICOPTER RECORDS . . .

and height; as no other nation had beaten any of the other helicopter records, she held all existing officially confirmed performances in this class.

Soon after the war America set about gaining the records, and pushed up all the figures considerably. In 1948 Great Britain made the first attempt on the speed record over the 3 km course, when Basil Arkell flew the Fairey Gyrodyne at 200.0637 km/hr (124.31 m.p.h.). This figure stood as an international record for ten months, when it was beaten by America; it still stands as the only British national helicopter record.

The F.A.I. recognizes no fewer than 36 different records for Helicopters (Class G). They are:—

Speed.—Over 3 km course; over 100, 1,000, 2,000, 5,000, 10,000 and above 10,000 km closed circuit; over 1,000, 2,000, 5,000, 10,000 and above 10,000 km closed circuits with payloads of 1,000, 2,000, 5,000, 10,000 and above 10,000 kg.

Height.—Maximum height; maximum height with payloads of 1,000, 2,000, 5,000, 10,000 and above 10,000 kg; greatest load carried to 2,000 m.

Distance.—In straight line, without landing or refuelling; over closed circuit, without landing or refuelling.

(N.B.—Although the duration record of 9 hr 57 min set up by America in 1946 is still included in the F.A.I. Records List, duration records for Helicopters, and for any other type of aircraft except balloons (Class A) and gliders (Class D) are no longer recognized.)

No special requirements are necessary for an attempt to be made on a record in Class G, other than those specified by the Royal Aero Club, acting as United Kingdom representative for the F.A.I. and enforcing the *Code Sportif*.

As an example of what an attempt on a helicopter record involves, the following conditions for an attempt on the speed record over the 3 km course may be given.

To begin with, as much notice as possible, and not less than seven days in any case, must be given to the Royal Aero Club of intention to make an attempt, together with full details of the helicopter and pilot. Club officials then measure out a course, either by direct measurement or observation or by other F.A.I.-approved means, which must be certified by a chartered surveyor as accurate.

The approach to the course must be 500-1,000 m long, and the extremities of the course itself marked by pylons so that the pilot and the stewards and timekeepers (at the entrance to the approach and at the starting and finishing lines) can clearly observe the flight. For the same reason the helicopter must not fly higher than 100 m.

The pilot must approach the course in level flight, and over the course itself the mean path of the helicopter must not be at such an angle that the speed is thereby increased. A sealed barograph is carried in the aircraft, and the chart must be produced afterwards and included in the dossier of documents submitted for official confirmation. The dossier also includes certificates from the stewards and timekeepers stating that the official conditions of the attempt were complied with, and that the figures recorded are correct.

Four flights over the course are made, two in each direction, and the average speed recorded is the figure accepted as the record performance. If more than four are made, the best of any four consecutive flights, provided they are made within a time limit of 30 minutes, may be selected and submitted for confirmation. A new record must exceed an existing one by at least 1 per cent before it will be confirmed. The present 3 km speed record set up in a Sikorsky S-51-1, is 208.494 km/hr, so any helicopter trying to beat this must fly at about 211 km/hr (142 m.p.h.).

The following tables indicate the progress of helicopter records in all categories since 1924.

SPEED

Date	Pilot	Helicopter	Engine	Place	Record
					(km/hr.)
		20 km Course			
14/11/36	M. Claisse (France)	Bréguet-Dorand	300 h.p. Hispano-Suiza	Villacoublay	44.692 km/h
26/6/37	E. Rohlfs (Germany)	Focke Wulf Fw 61	160 h.p. Siemens Sh 14	Bremen	122.533 km/h
		1,000 km Closed Circuit			
14/11/46	D. H. Jensen and W. C. Dodds (U.S.A.)	Sikorsky R-5a	450 h.p. Pratt & Whitney R-985	Wright Field	107.251 km/h
		3 km Course			
28/6/48	B. H. Arkell (Great Britain)	Fairey Gyrodyne	500 h.p. Alvis Leonides	White Waltham	200.0637 km/h
27/4/49	H.E.Thompson (U.S.A.)	Sikorsky S-52-1	245 h.p. Franklin O-425-1	Cleveland	208.494 km/h
		100 km Closed Circuit			
6/5/49	H.E.Thompson (U.S.A.)	Sikorsky S-52-1	245 h.p. Franklin O-425-1	Milford	197.545 km/h

ALTITUDE

Date	Pilot	Helicopter	Engine	Place	Height (metres)
*14/9/24	E.Oemichen (France)	Oemichen	180 h.p. Le Rhône	Arbouans	1
*14/9/24	E.Oemichen (France)	Oemichen	180 h.p. Le Rhône	Arbouans	1
13/10/30	M. Nelli (Italy)	d'Ascanio	95 h.p. Fiat A.50	Rome	18
22/9/36	M. Claisse (France)	Bréguet-Dorand	300 h.p. Hispano-Suiza	Villacoublay	158
25/6/37	E. Rohlfs (Germany)	Focke Wulf Fw 61	160 h.p. Siemens Sh 14	Bremen	2,439
29/1/39	K. Bode (Germany)	Focke Wulf Fw 61	160 h.p. Siemens Sh 14	Delmenhorst	3,427
10/2/47	E. Cassell (U.S.A.)	Sikorsky R-5a	450 h.p. Pratt & Whitney R-985-AN5	Patterson Field	5,842
21/5/49	H.D. Gaddis (U.S.A.)	Sikorsky S-52-1	245 h.p. Franklin O-425-1	Bridgeport	6,468

* Note: For altitude with 100 kg. and 200 kg. payload respectively.

DISTANCE

Date	Pilot	Helicopter	Engine	Place	Record
		Distance in Straight Line			
18/4/24	Marchese Pescara (France)	Pescara	180 h.p. Hispano-Suiza	Issy-les-Moulineaux	736 m
10/10/30	M. Nelli (Italy)	d'Ascanio	95 h.p. Fiat A.50	Rome	1,078.6 m
26/6/37	E. Rohlfs (Germany)	Focke Wulf Fw 61	160 h.p. Siemens Sh 14	Bremen	16.400 km
25/10/37	Fraulein H. Reitsch (Germany)	Focke Wulf Fw 61	160 h.p. Siemens Sh 14	Bremen	108.974 km
20/6/38	H. Bode (Germany)	Focke Wulf Fw 61	160 h.p. Siemens Sh 14	Fassberg-Rangsdorf	230.248 km
22/5/46	F. T. Cashman and W. E. Zinn (U.S.A.)	Sikorsky R-5a	450 h.p. Pratt & Whitney R-985-AN5	Wright Field-Logan Field.	1,132.337 km
		Distance in Closed Circuit			
14/12/35	M. Claisse (France)	Bréguet-Dorand	300 h.p. Hispano-Suiza	Villacoublay	500 m
24/11/36	M. Claisse (France)	Bréguet-Dorand	300 h.p. Hispano-Suiza	Villacoublay	44 km
26/6/37	E. Rohlfs (Germany)	Focke Wulf Fw 61	160 h.p. Siemens Sh 14	Bremen	80.604 km
14/11/46	D. H. Jensen and W. C. Dodds (U.S.A.)	Sikorsky R-5a	450 h.p. Pratt & Whitney R-985	Wright Field	1,000 km

DURATION

Date	Pilot	Helicopter	Engine	Place	Time hr	min	sec
8/10/30	M. Nelli (Italy)	d'Ascanio	95 h.p. Fiat A.50	Rome	8	0	45
24/11/36	M. Claisse (France)	Bréguet-Dorand	300 h.p. Hispano-Suiza	Villacoublay	1	2	50
25/6/37	E. Rohlfs (Germany)	Focke Wulf Fw 61	160 h.p. Siemens Sh 14	Bremen	1	20	0
14/11/46	D.H.Jensen and W.C.Dodds (U.S.A.)	Sikorsky R-5a	450 h.p. Pratt & Whitney R-985	Wright Field	9	57	0

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FOR SAFETY in CONTROLS

Preventing Risk of Incorrect Assembly of Chain-and-Cable System

EVERYONE concerned with aircraft design and maintenance is aware of the dangers of control-reversal inherent in assembly of sprocket-and-chain systems of actuation and of the various measures which have been taken, officially and unofficially, to guard against them.

Briefly, there are four pitfalls, and they lie in the risk of:—

(1) Connecting the wrong ends of operating cables of the same system.
(2) Connecting ends of operating cables belonging to different systems.
(3) Reversing the chain end to end on its sprocket.
(4) Allowing the chain to gear on the wrong face where two sprockets are operated by the same chain.

The established practice for dealing with eventualities (1) and (2) is the use of non-interchangeable connectors, but this fails to cover (3) and (4).

Existing regulations stipulate that all sprockets should be provided with a close-fitting guard to prevent the chain riding the sprocket, and this requirement is fully met in the arrangement shown. A standard chain could be accommodated in four different positions on the wheel by virtue of its ability to gear on two faces and its reversibility end to end; but with the chain designed as in Fig. 1, in conjunction with (a) a shroud on the sprocket and (b) the chain guard, only one position is possible, as shown in Fig. 2. An attempt at assembly in any other way will cause the chain to foul in a manner that will be immediately apparent and, indeed, make the control totally unworkable.

At the same time, the ability of the chain to gear on both faces is not sacrificed. Such a requirement can arise when more intermediate sprockets are to be operated or toothed jockeys are used, and the required direction of rotation is not the same for all points. This case is illustrated in Fig. 3 where the arrangements at wheel "Y" are as in Fig. 2 but where wheel "X" is required to rotate in the opposite direction and must, consequently, gear with the other side of the chain. The chain can be placed only on the underside of that wheel.

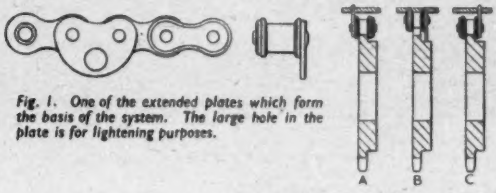


Fig. 1. One of the extended plates which form the basis of the system. The large hole in the plate is for lightening purposes.

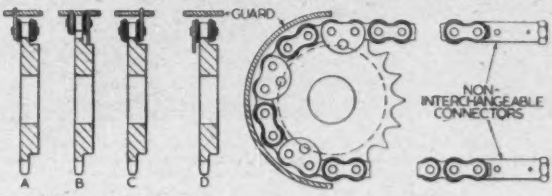


Fig. 2. Illustrations of the three cases of incorrect assembly, showing how the extension-plate would foul either the guard (A and C) or the shroud on the sprocket (B). At D the correct and only possible assembly is shown; it is seen in side elevation immediately above.

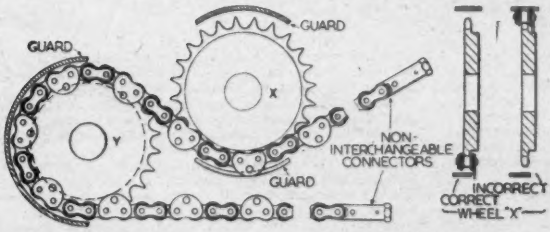


Fig. 3 (left). This view shows how, by an appropriate arrangement of guards, the chain can be used with jockey-sprocket or similar layouts.

The complete system thus involves four features, viz., the irreversible chain, the guard in compliance with standing regulations, the shroud on the sprockets and, finally, non-interchangeable connectors in accordance with present practice.

The Renold and Coventry Chain Co. state that although they have acquired the Raddings and Pearse chain patent (recently referred to in *Flight*), the design which they have submitted to the S.B.A.C. embodies a feature not covered by this patent. In order to make their system freely available to the aircraft industry they have not applied for a patent.

Illustrated here is a method which the Renold and Coventry Chain Co., Ltd. (28 Deansgate, Manchester, 3), has submitted for S.B.A.C. standardization and which, in conjunction with the use of non-interchangeable connectors, effectively guards against all four contingencies.

Fig. 1 shows the design of the chain. It consists of standard parts, except that extended outer plates are arranged at appropriate intervals, preferably of four pitches. The weight aspect is observed by placing the extended plates on one side of the chain only, making the extension as small as possible and providing it with a lightening hole.

Fig. 2 illustrates the principle of operation. The aim in the first place is to prevent end-to-end reversal of the chain. This is achieved, first, by providing a shroud on one side of the wheel and, secondly, by making use of the chain guard.

SUCCESSFUL APPRENTICES AT BROUGH

THE twentieth annual presentation of apprentice bonus awards took place at Brough recently, when over 180 apprentices at Blackburn and General Aircraft, Ltd., saw J. W. Headley receive the S.B.A.C. Certificate of Apprenticeship.

Mr. J. Hall, the company's development engineer, presided and Mr. T. Bancroft, general works manager, presented over £120 in awards to the 74 successful trainees. Amongst those present were Mr. T. A. Wolstenholme, apprentice supervisor, and Mr. Walker, principal of the Hull Technical College, together with some of his colleagues who instruct at evening classes and on the Diploma Course in Aeronautics.

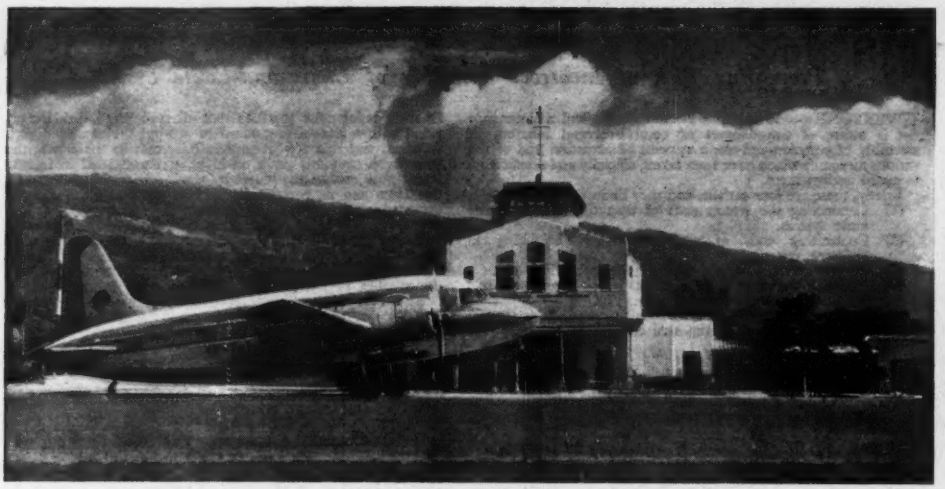
Results in the Diploma Course were notable, inasmuch as 12 out of 13 students were successful and, of these, eight obtained distinctions in one or more subjects. The most outstanding student was David Needham, who is now studying for the Diploma of the College of Aeronautics, Cranfield; in his examination he obtained six distinctions and was awarded the Higher National Diploma Prize of the Institution of Mechanical Engineers.

A total of 117 apprentices attended evening classes, and 63 per cent were successful in their examinations. C. Rodgers obtained his Higher National Certificate and eleven apprentices obtained their Ordinary National Certificate, whilst M. V. Brignall headed the Merit List.

MR. W. E. GOUGH

MEMBERS of technical staffs on the engine side of the industry, in particular, will be sorry to learn of the death of Mr. W. E. Gough, A.M.I.E.E., who was well known to many of them by virtue of his work on the aircraft-magneto design staff of the British Thomson-Houston Co., Ltd.

After serving in the First World War, Mr. Gough joined the main B.T-H. works at Rugby as an apprentice, and in 1922 went to their magneto works at Coventry, where he began the specialization in aircraft-engine ignition which continued up to the time of his death. He was 50 years of age.



VIKINGS ABROAD: Among the many climes in which the sturdy Vickers Viking plies its trade to-day is the tropical setting of Haiti, which has recently been included in the Caribbean route of British West Indian Airways. The company operates five of these machines.

CIVIL AVIATION NEWS

DISCUSSING EUROPE'S AIRPORTS

THE second conference of the Western European Airports Authorities has been taking place this week at Ariel House, London headquarters of the M.C.A. Representatives from Belgium, Denmark, France, the Netherlands, Switzerland and the United Kingdom have exchanged views on various questions of common interest which affect the commercial and economic aspects of airport management.

Two of the major points of the discussion were the possibility of standardizing present administrative methods throughout Europe and the rational planning of airport terminals in the interests of the passenger. The first of these conferences took place in Paris last April.

AER LINGUS WANT VISCOUNTS

IN view of Aer Lingus' plans to improve their existing services and open new ones, the recent announcement that the company are negotiating for the purchase of four Vickers Viscounts is not altogether unexpected. The quest for new aircraft to replace (on some services) and augment their present fleet of Dakotas has taken their executives to America as well as to see British manufacturers. No more advanced or luxurious machine could have been selected than the Viscount with its four Rolls-Royce Dart turboprops, and the choice brings Aer Lingus into line with its B.E.A. associates (B.E.A. hold 30 per cent of the Irish company's shares) who are also, of course, to operate Viscounts.

Surprise has been expressed in some quarters that Aer Lingus, a comparatively small company (employing a staff of 1,281 in 1950), should plan to introduce such an advanced and so far untried aircraft, but it must be remembered that at least 2½ years are likely to pass before deliveries could begin—unless, as seems possible, B.E.A. are prepared to release some of the 25 Viscounts they have ordered and of which the first are expected some months earlier. In the meantime, competition on the Continental routes grows keener, and congestion at certain key airports, particularly London, is worrying Aer Lingus, who feel that it will be even worse in two or three years' time; the capacity of the Viscount—twice that of the Dakotas—will, they believe, help to ease their problems. The purchase decision no doubt carries B.E.A.'s blessing and a promise of co-operation.

Some people have thought that Aer Lingus would favour Ambassadors to augment their fleet. These machines have two conventional Centaurus piston-engines and are, it is understood, cheaper to purchase. Such a decision might also in some ways have suited B.E.A. and Rolls-Royce better, if for no other reason than that additional Darts are going to be hard to come by in view of the engine manufacturer's preoccupation with military orders for turbojets. Ambassadors may, incidentally, lend themselves well to turboprop conversion at a later date, and axial Mambas—single or double—are possibilities.

We may be certain of one thing: that, after Dakotas, passengers will appreciate the speed and smooth quietness of the Viscount, which will probably be operated with a crew of five including two stewards.

Plans to rejuvenate Aer Lingus Dakotas, perhaps along the lines of B.E.A.'s Pionair rebuilds, may be announced soon. These aircraft are expected to give at least five more years of service, probably with increased seating capacity.

Regarding route plans, Aer Lingus will open their new three-times-a-week Bristol service on May 3rd, and the Starflight summer-night services to London will be introduced earlier this year. London-bound aircraft will leave between 2100 and 2200 hr, and the last return flight will take off before midnight.

During the summer, in addition to their British Isles city services to London, Glasgow, Manchester, Birmingham, Liverpool, Bristol, Dublin and those to the Isle of Man, Jersey and to Shannon, there will be outward and return services to Amsterdam and Paris (the Viscount will substantially reduce the present four hours for this service). Intended expansion of services includes flights to Spain, Germany and Italy.

I.A.T.A. MEDICAL CONFERENCE

THE Medical Committee of the International Air Transport Association was due to hold its first conference in Cairo on February 5th. The rendezvous is appropriate, as Egypt is widely implicated in quarantine regulations to prevent the spread of such Oriental diseases as cholera and yellow fever.

The growth of I.A.T.A.'s Medical Standing Committee from a small panel, formed three years ago, bears witness to the growing importance of the medical aspects of international air transport. The Committee—referred to in *Flight*, September 28th, 1950—is intended to assist airline doctors to co-ordinate their world-wide activities, for the benefit of both aircrews and passengers.

The terms of reference direct the committee to investigate the physiological, psychological, hygienic and general medical aspects of all air-transport matters which may affect the safety and efficiency of aircrews and the comfort of passengers, both in flight and at terminals. Particular attention is being paid to such subjects as the design of aircraft equipment, airport accommodation, food and water supplies, sewage disposal, fumigation of aircraft, quarantine and immunization of crews and passengers.

Representing the United Kingdom at the Cairo session are Sir Harold Whittingham, B.O.A.C.'s director of medical services, and Dr. A. B. Barbour, the chief medical officer of B.E.A.

Altogether, 18 medical officers, representing most of the world's major airlines are members of the committee. All are experienced in aviation medicine, having, in most cases, devoted the whole of their professional careers to the study of this subject.

On the agenda are the particular problems of aircrew fatigue and flying-time limitations, the carriage of sick passengers, airport hygiene, and a review of those provisions of the draft International Sanitary Regulations of the World Health Organizations which concern air transport.

The committee will also review I.C.A.O.'s medical requirements for aircrew in the light of recent experience and will discuss the standardization of oxygen regulations. Also within the scope of the conference are medical arrangements to meet emergencies at airports, the minimum requirements for first-aid kits carried in airliners—including the provision of morphine—and the physiological requirements which would arise in the event of sudden decompression at high altitudes.

In that the recommendations of the I.A.T.A. Medical Committee are based on practical experience and will therefore emphasize the human aspect involved in any mandatory requirements which may be issued by governments, the World Health Organization or I.C.A.O. The committee's activities should be of great value.

THE END OF "QBI"

ON the introduction of Phase II of the United Kingdom National Airways system, which will take effect on a day this month yet to be announced, use of the familiar QBI signal, advising pilots that flying under IFR is compulsory within control zones, is to be discontinued. Except in the case of take-offs and landings at airfields in a control zone (when airfield met. observations will determine I.F.R. conditions) it will then be the sole responsibility of aircraft commanders flying, or intending to fly, in controlled areas in daylight, to decide for themselves whether the conditions existing permit the application of visual-flight rules.

If the weather does not permit V.F.R. to be used the pilot must, unless he has received permission from Air Traffic Control to do otherwise, either fly under I.F.R. or remain outside the control area. At night all flights in control zones will be made under I.F.R.

To provide an additional safeguard for aircraft approaching or departing from the major civil airports of Bovingdon, London and Northolt (other airfields will be added to this list shortly) the M.C.A. has stipulated that any pilot flying within five nautical miles of such airfields, and less than 2,000ft above, must first notify the airfield control by radio of his position, height and track, and must then maintain a continuous listening watch on the frequency in use. He must also comply with all instructions which the controller may pass to him.

In cases where airfields are located within five miles of the major airports mentioned above, special arrangements are being made so that aircraft not equipped with radio may continue to operate from these airfields.

AIR FRANCE RESULTS

THE president of Air France recently announced in Paris that the company had enjoyed a considerable expansion of its activities last year. The number of passengers carried rose by nearly 20 per cent to 770,000, a figure seven times higher than that for 1938. Freight increased by 15 per cent to 38,000,000 ton-kilometres and a figure of 14,000,000 ton-kilometres was achieved in the carriage of mail. With the addition of 20 new services inaugurated in 1950, the company now operates a route-network of some 218,000 km. By virtue of a Government subsidy—based on distance flown—which Air France receives, the profit and loss account for the past financial year is expected approximately to balance.

BREVITIES

LAST Tuesday the Minister of Civil Aviation, Lord Pakenham, met the Welsh Advisory Council for Civil Aviation to discuss air services and the future of airports in Wales. It is understood that Cardiff airport was one of the major points reviewed. The Minister's conclusions are to be made known later.

* * *

Helicopter Air Service, which for the past two years has operated an extensive network of mail services in the Chicago area, has now applied for permission to carry passengers between points within a 50-mile radius of Midway Airport.

* * *

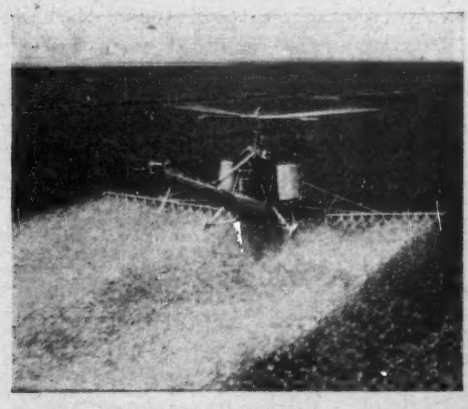
M.C.A. Information Circular No. 20/1951 contains a complete list of four-letter place-name abbreviations for use on all aeronautical fixed telecommunications services. The list has been compiled from details published by I.C.A.O. and from separate lists published by I.C.A.O.'s contracting States in their respective Notices to Airmen.

* * *

United Air Lines are now training approximately 80 new first officers in preparation for the delivery of 20 DC-6Bs which the company has on order. Half of them will be drawn from flight engineers who are already qualified pilots.

* * *

Up to June 30th, 1950, Trans-Australia Airlines had flown almost 40,000,000 miles without a single fatality. In the year ended June 30th a total of 25,362 scheduled and 101 charter flights were recorded. The company has now inaugurated three inland routes in Queensland, bringing its present unduplicated route-mileage figure to over 20,000. During the recent rail strike in Victoria T.A.A. supplied 23 special freighter services weekly to cope with more than 1,000,000 lb of mail that had



HOME FROM THE WAR: Two Hiller 360s used by Pest Control, Ltd., to combat the ravages of the crop-destroying jassid in the Egyptian cotton-fields (as reported in "Flight" last week) were recently flown back to this country in a Silver City Airways Bristol Freighter (right).

CIVIL AVIATION NEWS . . .

to be carried during the period of the strike. Incidentally, D. H. Drovers are now being used on the T.A.A. Flying Doctor services which, in the year ended June 30th, made 158 mercy flights.

* * *

Following the temporary grounding of 19 B.E.A. Vikings as a result of the discovery of a cracked airscrew hub (as recorded last week), de Havilland Propellers, Ltd., state that these aircraft —unlike many Vikings in service in various parts of the world— were not fitted with D.H. airscrews.

* * *

A proposal by Eastern Airlines to operate "air coach" services between Miami and San Juan at a fare level of four cents per mile has been rejected by the C.A.B. The Board is of the opinion that Eastern's net revenue position would deteriorate if such proposals were put into operation and that, in any case, they would probably have an adverse effect on Eastern's competitor serving these two points—Pan American World Airways.

* * *

In a news-item last week on the 1950 progress of International Aeradio, Ltd., it was stated that ground equipment was now being installed at 28 airfields in South Africa. This should, of course, have read "East Africa." The sites range from the international airport at Eastleigh to airstrips such as those at Nachingwea and Kitale.

* * *

Eastern Airlines and P.A.W.A. have concluded an agreement which will permit passengers flying between New York (or other points served by the former company) and certain Latin-American destinations served by the latter to travel over the entire route in the same aircraft. This arrangement is designed to give higher aircraft utilization and more efficient use of facilities which, it is hoped, will eventually allow fares to be reduced. The agreement may also be accepted by Panagra, Pan American's associate serving the west coast of South America.

* * *

American Airlines are planning to replace the Curtiss-Wright electrically controlled airscrews on their entire fleet of 79 Convairliners and 49 DC-6s by Hamilton Standard airscrews. The value of this contract is estimated at $4,000,000—probably the largest single order for components in airline history.

* * *

During the coming summer season Aer Lingus will operate more services than ever before. During the peak period as many as 100 flights weekly will be flown on the London-Dublin route alone. The popular Starflights (late night services from London to Dublin) are being resumed and a new service will also be opened between Dublin and Bristol on May 3rd, with an initial frequency of three times weekly.

* * *

The United States National Production Authority has granted permission to the C.A.A. to give top priority to the construction and maintenance of commercial aircraft. This is the first time that the N.P.A. has authorized such priority for civil machines and means, virtually, that manufacturers will now treat orders for military and commercial aircraft with the same degree of urgency. A similar arrangement will apply to the purchasing of aircraft equipment.

* * *

The latest analysis of mileage completed by B.O.A.C. flying personnel shows that 264 aircrew-members—or more than one fifth of the Corporation's total flying personnel—have each flown more than a million miles; together they have recorded some 287,000,000 miles. Of this number, 139 are captains who have qualified as "mileage millionaires." Seventeen captains are now "double mileage-millionaires," while Capt. O. P. Jones, who has been flying since 1917, is the only pilot still serving to have exceeded the 3,000,000-mile mark.

CLUB AND GLIDING NEWS

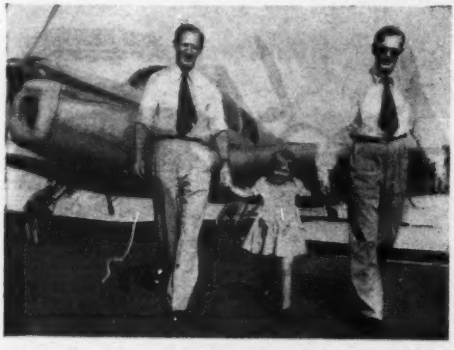
THE Southend Municipal Flying School is now operating a Dart Kitten and a Slingsby Motor Tutor; both machines are proving popular with club members. The Kitten logged eight hours and the Tutor four hours during their first week-end of service, when the weather fortunately remained fine on both days. The flying charge for either of these aircraft is 30s per hour and the club invites all licensed pilots to visit Southend to try them out. With flying being offered at such an economical rate, and in view of the fact that there is no entrance fee or subscription, the invitation seems attractive.

The club reports that total flying time showed a considerable improvement in January, when 130 hr were recorded, as compared with only 50 hr during the previous month. At the moment the school has only one flying instructor and is therefore closed on Mondays.

* * *

THE Cheltenham Aero Club is now arranging a series of weekly technical courses for pilots. They will begin in four weeks' time and are available to all who, in the event of war, would be useful either as fully or partly trained pilots. They are also designed for students who are, at the moment, under training for their P.P.L., but who have fallen behind with the required technical studies for this licence. Those desiring to enter for the C.A.C.'s new course need not already have flying experience—a certain amount of flying will be possible during the course if they desire it—but they will be required to pass a medical examination if not already in possession of a Student Pilot's Licence. They must also be considered suitable in other respects for further training by the R.A.F.

Incidentally, the Cheltenham Aero Club is shortly to lose its chief instructor, F/L. Paul Bowry, who is joining the R.A.E., Farnborough, as a test pilot. His place will be taken by F/L. J. P. Walker, an instructor from the Central Flying School, Little Rissington.



LONG HOP: Seen on arrival at Guildford airfield, Perth, on January 17th are Mr. F. Burt and Mr. L. McTaggart, who had just flown a single-engined Miles Mercury from the United Kingdom. They left England on November 4th and—not aspiring to break any records—flew by easy stages, taking 64 days to complete the trip.

* * *

IN *Flight* of January 18th it was reported that Brooklands Aviation, Ltd., had decided to close down the South Coast Flying Club at Shoreham on March 31st. It is now learned that although Brooklands Aviation are withdrawing their interest from that date, other financial arrangements are being made by which the club will continue to operate, although under new ownership. No details are yet available but it is believed that interruption of the club's normal flying programme is unlikely and V.R. and private pilots will be welcomed as usual.

* * *

VERY little flying has been possible for members of the Surrey Gliding Club during the past two months and consequently the accent has been on maintenance work on club machines. Two Olympias and a Tutor are being refurbished and members are now lending a hand with work on both aircraft and M.T. vehicles.

On January 6th the club held a committee meeting, at which one of the major points of discussion was concerned with the necessity of increasing revenue during the coming year. In spite of an all-out effort in 1950 to "close the gap" by intensive flying, the S.G.C. did not succeed in balancing its budget. Last year was considered to have been "meteorologically meagre," and since there is no guarantee that this year will be any better the committee feels that the remedy for improving the club's financial status will have to be sought elsewhere.

The C.F.I. at Redhill (the S.G.C.'s base) has stressed the need for members to get machines out early on days when soaring becomes possible, and this is advice which other clubs might profitably follow. The price of glider joy-rides is being increased this year to 5s (i.e., 10s with the day-membership fee), while the entrance fee for new members is being raised to £4 4s.

A number of discussions on technical subjects have been arranged, to take place each Sunday until flying begins again.

OPTIMUM BRAKING

Westinghouse System for Wheel-skid Prevention

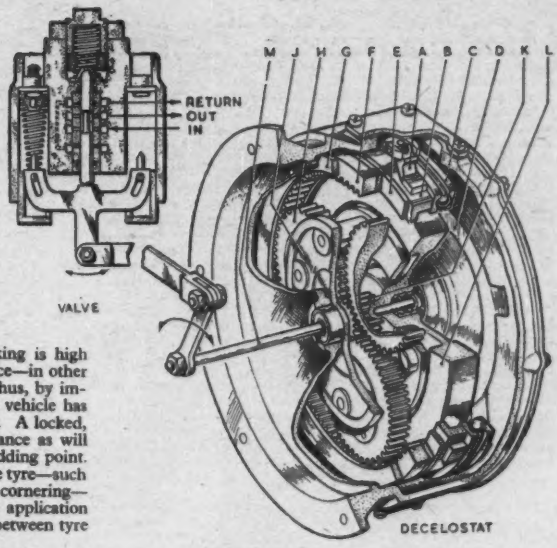


Fig. 1. Sectional detail of Decelostat and valve. The Decelostat is bolted to the landing wheel and, via the torsion-shaft running coaxially through the stub-axle, actuates the valve.

A CARDINAL requirement for good braking is high resistance to slip between tyre and surface—in other words, a good coefficient of friction. Thus, by implication, if the wheels stop rotating before the vehicle has stopped then the braking becomes less effective. A locked, skidding wheel will not stop in so short a distance as will a wheel which is braked to just short of the skidding point. Neglecting the imposition of any side-force on the tyre—such as occurs, for example, when a road vehicle is cornering—what makes a tyre skid? It is, obviously, the application of a force greater than that which the adhesion between tyre and surface can accommodate..

It is unnecessary here to go into the technicalities of braking as a study in mechanics; suffice it to state that, in order to provide sufficient braking force in ideal conditions, modern aircraft-wheel brakes must be of such power that the tyre will inevitably skid on surfaces which are less than ideal—and, of course, such conditions will apply with the greater frequency. To some extent the position can be modified by skilled application of the brakes, but so many factors conspire against a pilot being able to apply the brakes with anything like the delicacy of control enjoyed by, for example, the car-driver, that there is need for some means whereby human skill may be replaced by mechanical selection. Such is the designed duty of the Decelostat which, made by the Westinghouse Brake and Signal Co., Ltd. (82, York Way, London, N.1), is the British version of an American development.

Before tracing the succession of events which occur in the Decelostat it is advantageous briefly to review what the device does. This can be stated quite simply: it releases the brakes immediately the tyre slips preparatory to skidding, and re-applies braking pressure as soon as the tyre stops skidding. This cycle is capable of rapid execution, e.g., *circa* six to eight reversals per second. Therefore, no matter how hard the brakes are applied, optimum retardation is ensured for the adhesion conditions obtaining, in that the tyre is maintained as long as possible at just below the skidding point throughout the time-to-stop period.

The Decelostat unit has a diameter of 6in, is 2$\frac{7}{16}$in deep and weighs 3$\frac{1}{2}$ lb. As will be seen in the cut-away drawing (Fig. 1) it is flange-bolted to the aircraft wheel rather in the manner of a hub-cap. Diametrically opposed on the inside of the Decelostat case are a pair of pawls, which engage buttress stops on the outside diameter of a clutch-ring. On the outboard side of the clutch-ring is an eight-ball thrust-race, against which bear the radial leaves of a spring-ring reacting against the end-wall (cover-plate) of the unit. Sandwiched between the inboard face of the clutch-ring and a bearing-plate pegged to the casing is a phosphor-bronze friction-annulus, and an internally-toothed ring-gear with which mesh three planet-pinions. These in turn mesh with a central sun-gear which is, in fact, formed on the shaft of a flywheel. From the planet carrier extends a torsion-shaft to actuate the Decelostat valve. The fact that the valve is a stationary unit anchored to the undercarriage-leg assembly means that the torsion-shaft has to pass coaxially through the hollow core of the wheel stub-axle.

In that it is bolted to the wheel, the Decelostat casing can be regarded as an integral part of the wheel structure; and when, on touch-down, the wheel is spun-up, the rotation is directly applied through the pawls to the clutch-ring. At this instant, however, the flywheel is stationary, but spring pressure applied through the thrust bearing squeezes the ring-gear between the bearing-plate, friction annulus and clutch-ring, and tends to make them rotate together. The exertion of the spring being less than the force required to spin-up the flywheel under the high initial rate of acceleration, the clutch slips and rotation is therefore applied to the flywheel gradually. ("Gradually" is, of course, a relative term; in point of fact, the time-lag is infinitesimal.) The gear ratio between ring-gear and flywheel is 1 : 7 and, as a result, the latter is rotated at a speed seven times greater than that of the undercarriage wheel and in the opposite direction. Whilst the flywheel is being accelerated, there is necessarily a torque reaction imposed on the planet carrier, and it is this force which is utilized to actuate the valve by means of the torsion-shaft.

When the flywheel has attained full speed, torque reaction on the planet carrier is relieved, and a graduating spring in the Decelostat valve returns

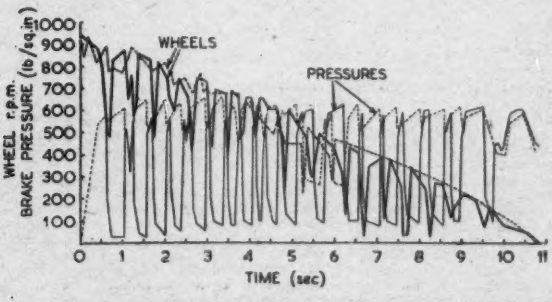


Fig. 2. Curves of wheel speed and brake pressure fluctuations, showing effect of Decelostats fitted to rear wheels of B-26 tandem undercarriage during stop from 79 m.p.h. on wet concrete runway.

OPTIMUM BRAKING . . .

the actuating linkage to neutral. In this condition, the valve passes the full (pneumatic or hydraulic) power from the pressure source to the wheel brake. As may be seen from Fig. 1, the Decelostat valve (hydraulic version) is in essence a simple piston-type unit. Pressure oil entering the unit, when braking is initiated by the pilot, is free to pass out of the unit to the wheel brakes. Immediately the Decelostat reacts, the Y-lever of the valve will rock about one or other of its fulcra to lift the valve piston, and so cut off the supply of pressure oil to the wheel brakes; at the same time the oil between valve and brake is released into the return circuit. The valve piston is returned to neutral by a direct-acting compression spring, whilst the conical spring to the left of the piston is a graduating medium which, in addition to returning the actuating yoke to neutral, also serves to compensate the shock load on the actuating linkage when subjected to snap-torque during the initial spin-up on landing.

Immediately after touch-down, and the flywheel having been fully speeded up, it is assumed that full brake pressure is applied. For ease of explanation, it may further be assumed that the landing wheel at once starts to skid and thus ceases to rotate; necessarily, the Decelostat casing would also come to rest. The flywheel, however, will continue to rotate, and the torque reaction on the planet carrier will be transferred through the torsion-shaft to actuate the valve and so release the brakes. As soon as the brakes are released, the landing wheel will again pick up speed, and the cycle of events (as described in the initial touch-down case) to bring the flywheel up to speed and return the actuating linkage to neutral will be re-established.

Test Results

In this explanation we have, for the sake of simplicity, assumed extreme conditions which are, in fact, never obtained. When the deceleration rate of the landing wheel exceeds that at which an optimum stop (i.e., without skidding) can be made, the Decelostat instantly reacts to effect brake release. As the landing wheel accelerates back to normal speed the Decelostat again initiates brake release to preclude full braking being applied until normal speed has been attained. These two brake releases—deceleration and acceleration—occur in such rapid succession that they appear as one. The degree of brake release is dependent upon the time cycle which, in turn, is dependent upon an integration of the three variables of ground coefficient, wheel loading and brake pressure.

Tests conducted with the American Westinghouse Decelostat fitted to the tandem main wheels of a B-26-H Invader aircraft at Wright Field proved to be enlightening. Typical of the results obtained were those recording a stop from 85 m.p.h. on a dry concrete runway, during which full braking pressure was applied until the aircraft came to rest. On the starboard undercarriage the Decelostats reacted to effect two releases of the front wheel and six of the rear wheel; on the port undercarriage they effected no releases of the front wheel but 55 of the rear wheel. The greater number of releases on the rear wheels indicates the load transfer resulting from the high deceleration rate, and the difference between port and starboard releases is a function of the differential wheel-loading resulting from the lateral tilt of the aircraft during the landing run. The stop was accomplished in 11.7 sec, with an average retardation rate of 10.65ft/sec/sec. The accompanying performance curves (Fig. 2) are plots of the rear-wheel performance during a similar stop recorded from 79 m.p.h. on a wet concrete runway, and show respectively three brake releases for the starboard and 19 releases for the port rear wheels. This stop was accomplished in 10.84 sec with an average retardation rate of 10.72ft/sec/sec. This latter quantity is indicative of the effectiveness of the Decelostat for, as may clearly be seen from the curve, the brake releases were necessitated virtually throughout the total time-to-stop period.

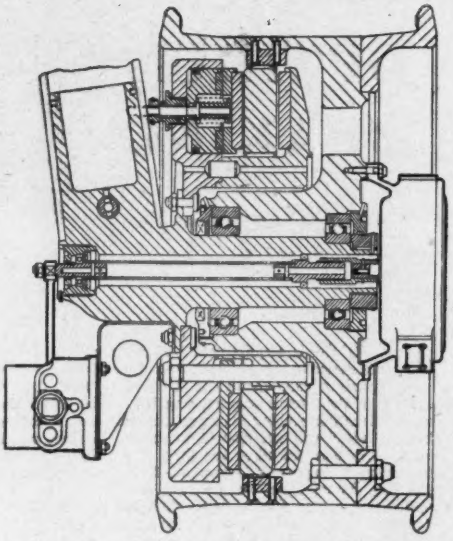


Fig. 3. Section through British Messier wheel for Vampire trials of the Decelostat. The mounting of the Decelostat and the valve is clarified by the heavier outline, as is the design of the single-disc brake.

The common foundation and technical liaison existing between the Westinghouse Brake and Signal Co., Ltd., in Great Britain, and the Westinghouse Air Brake Company in America, have made it possible for Decelostats to be made available—at Ministry of Supply request—for trials over here. These are shortly to be undertaken at Farnborough with a Vampire 1 in which the original pneumatic bag-type brakes have been replaced by hydraulically operated disc-brakes developed by British Messier, Ltd. In order that the Decelostat unit should not project beyond the tyre profile (Fig. 3), the wheel bearings have been moved closer together, so that the device is mounted inside that part of the wheel not accommodating the brake unit. The two bearings of the wheel are pressed into the inboard half of the wheel, the other half being a bolted-on flange. The brake consists of a light alloy back-plate, at each end of which a cylinder bore is machined. Hydraulic pistons operate in these bores and apply the brake pads on each side of a single, thick, brake disc, which is driven by means of dogs on the wheel.

A.S.T. CHIEF IN INDIA

GROUP CAPTAIN R. J. F. BARTON, O.B.E., managing director of Air Service Training, Ltd., left England on January 18th for a tour of the company's India and Pakistan establishments. His first port of call will be Bangalore, where he is to attend the official opening of the India Air Force Technical College which, for over a year, has been operated by A.S.T. under contract to the Government of India. G/C. Barton is then to visit Delhi, where he will meet Service chiefs.

He will next go to Karachi to inspect the Royal Pakistan Air Force apprentices' school at Korangi Creek and the twin-engine conversion school at Mauripur. Both of these schools were established, and are staffed, by A.S.T. Whilst in Pakistan G/C. Barton is to negotiate contracts with the Pakistan Government for the establishment of three important educational projects. In connection with these Mr. D. Crichton-Miller, headmaster of Fettes College, Edinburgh, and Mr. George Riding, late headmaster of Aldenham School, have already arrived in Pakistan to carry out a survey on behalf of A.S.T.

"BONDS OF FRIENDSHIP"

MANY people in this country feel that some practical recognition is due to the United States for the hospitality shown to British children during the war years, and for the numbers of gift parcels received here since the early days of the war. With this feeling in mind, Lady Moncreiffe recently visited the United States to test American reactions to her idea of establishing an organization to be called Bonds of Friendship, United Kingdom-United States, the main objective of which would be to maintain residential hostels for American troops stationed in Britain. In view of the growing numbers of—in particular—U.S.A.F. personnel now here, such centres are likely to be much in demand.

The sponsor found great enthusiasm for the idea in the United States, and has recently returned to this country to enlist support for the scheme. Practical encouragement is now needed, and any contributions addressed to Lady Moncreiffe, 44, Orchard Court, Portman Square, London, W.1, will, it is stated, be gratefully received and acknowledged.

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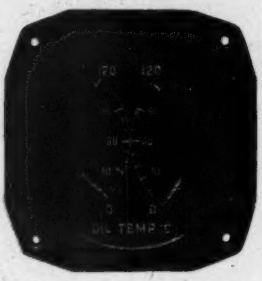

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METAL-to-METAL BONDING

—*for Aircraft Structures : Claims of the Redux Process*

By C. J. MOSS, B.Sc.*

THAT synthetic glues for wood were used extensively for making Mosquito and Hornet aircraft during the 1939-45 War, and are now used for making Vampires in many European countries, is well known to aeronautical engineers, but not so well known is the fact that, since 1944, synthetic glues for metals have been used in the production of many hundreds of military and civil aircraft.

A glue for metals, which gives joints stronger than can be obtained by riveting and which is also resistant to the severe conditions to which aircraft are exposed in service, offers the possibilities of savings in structure-weight and of aerodynamically cleaner wing and fuselage surfaces. Such a glue may also be expected to be of value in the manufacture of pressurized fuselages, because it will avoid the large number of small leaks occurring at the rivet heads and may also help to solve the difficult problem of making integral fuel tanks in aircraft wings.

Any savings in structure-weight or drag which may be possible on a high-performance, jet-propelled aircraft must be of even greater importance than on a piston-engined type, because of the relatively high fuel consumption of gas turbines. It is interesting, therefore, to learn that the Redux process of metal bonding has been used extensively by de Havilland Aircraft Co., Ltd., in the construction of the wings and fuselage of the Comet.

The earliest use of Redux in aircraft construction was in the manufacture of the Hornet single-seat fighter. The de Havilland Company was faced with a difficult problem because of the large wooden booms required for the wing spars. The difficulty was overcome by making the tension booms of aluminium-alloy extrusions but still using wood for the spar webs and compression booms. The metal and wood were then glued together so as to form a spar of remarkably low weight and high strength.

A somewhat similar design is used by Vickers-Armstrongs, Ltd., for the floors of the Viking and Viscount. Aluminium alloy top-hat stringers are bonded to the undersides of sheets of plywood to form floors whose upper surfaces are quite free from any rivet or bolt heads. B.E.A. Vikings have now flown for considerable numbers of hours and no trouble has been reported with the Redux. A more recent example of metal-to-wood bonding may be found in the fin of the Canberra bomber. The fin is of wooden construction because it houses aerials and it is attached to the extruded aluminium alloy spars by means of the Redux process.

It is interesting to note that Redux has already been used by The Bristol Aeroplane Co., Ltd., in the construction of their single-rotor and twin-rotor helicopters. The process has provided a convenient way of attaching metal trim-tabs to wooden rotor blades and has been of great value in making experimental metal rotor blades. It has also been used in the construction of the fuselages of both types.

Strength Characteristics

Although uses of the process for bonding metal to wood are of interest, the application of the system to all-metal structures is likely to prove of far greater importance. The need for smooth, thin wings is more pressing than ever, and the hitherto normal riveted construction is open to criticism, both because of the need to keep structure-weights to a minimum and because of the aerodynamic effect of the rivet heads. Determined efforts have been made to diminish this effect, either by machining the heads or by finishing the wing surface with special fillers. Spot welding has been used, but even this leaves small marks where the electrode makes contact with the skin.

A gluing process offers an entirely different line of approach.

Glued joints should be designed, as far as possible, for loading in shear. As might be expected, the breaking load varies in proportion to the width of the joint, but it is only proportional to the joint length for very small overlaps. For larger ones it scarcely increases with length of overlap. The strength of the joint also increases (a) with the thickness, and (b) with the mechanical properties of the metal test-pieces.

The explanation of this behaviour is to be found in the stress concentrations in the joints. The load is not uniformly distributed over the whole of the glued area, but is mostly taken by the ends of the joints. The stress concentrations may be considerably reduced by tapering the metal test-pieces, with a corresponding increase in failing load of the joint, but it seems unlikely that tapering the metal would be an attractive proposition in practice.

Another aspect of this matter is the way in which the strength of the joint varies approximately in proportion to the yield point (0.1 per cent proof stress) of the metal strips used to make the joints. The table giving failing loads of ½in overlap joints made from 20 s.w.g. strips of metal, illustrates this point.

Material	Failing load of Redux joint (lb/sq in)	Yield point of metal strip (tons/sq in)
Aluminium, half-hard	1,100	5.8
Alclad D.T.D. 390	3,600	15.0
do. D.T.D. 546	4,000	21.0
do. D.T.D. 687	5,000	26.0

The failing loads given for glued joints between strips of Alclad are several times higher than can be obtained with spot welding or riveting. Care must be exercised, however, in applying the results of these small-scale tests to the design of aircraft structures, and I believe that the following results are likely to prove of far greater interest to designers. This is particularly true in that many of them offer a direct comparison between the strengths of riveted and glued panels when tested in the way that they are loaded in an aircraft structure. The Gloster Aircraft Co., Ltd., tested some panels of a design somewhat similar to those used on the Meteor. They consisted of a 24 s.w.g. skin to which a 24 s.w.g. top-hat stringer was bonded. In compression this panel failed at an average load of 2.5 tons, while a similar riveted panel withstood an average load of only 1.8 tons. Thus the Redux-bonded panel carried an average load 40 per cent greater than that of the riveted panel. The corresponding figures for test specimens consisting of a 24 s.w.g. skin with two 24 s.w.g. stringers were 4.25 tons for Redux and 3.16 tons for riveting.

A further point must be borne in mind when considering these results. The panels were designed for riveting and not for Redux bonding. It is possible that had the stringers been modified (but without increasing their weight), still higher results with Redux might have been obtained. Redux bonding is an entirely new technique, and the best results are obtained only if the design is made for gluing. A design which is suitable for riveting is not necessarily suitable for gluing, and vice versa.

Another interesting series of tests has been carried out by the Bristol Company. In these experiments a panel reinforced by stiffeners was bolted round its edges to a box and submitted to a fluctuating air pressure similar to that occurring, for example, on the trailing edge of an aircraft wing. The panels were all 4in × 24in and the ½in × ½in × 20 s.w.g. stiffening angles were all parallel to the shorter edge.

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* *In a paper before the Graduates' and Students' Section of the R.Ae.S. This report is reproduced, in a slightly abbreviated form, from a recent issue of "The Journal of the Royal Aeronautical Society."*

METAL-to-METAL BONDING . . .

The first panels had 22 s.w.g. skins and were of a riveted construction. One failed after 0.3×10^6 cycles of stress and the second, of a slightly modified design, after 0.7×10^6 cycles. The failures were of a similar kind to those which had occurred in flight, i.e., by skin cracks beginning at rivet holes.

When a similar panel in which the stringers were Redux-bonded to the 22 s.w.g. skin was tested, failure did not occur until after 4.5×10^6 cycles of stress, and only then because the metal stringer cracked. The Redux bond appeared to be in perfect condition after more than six times as many stress reversals as were required to cause skin cracking at the stress concentration of the riveted panel.

Three further tests were carried out, using the same cycle of air pressures in the box, but with 24, 26 and 30 s.w.g. skins. For the two thinner panels the stiffeners were spaced at 4in intervals, but for the two heavier ones the spacing was 8in. The following results were obtained:—

24 s.w.g. panel failed after 2.1×10^5 cycles by cracking of the metal stringer. Redux bond still intact.

26 s.w.g. panel failed after 2.4×10^5 cycles. Redux bond failed.

30 s.w.g. panel failed after 5×10^5 cycles by cracking of the metal stringer. Redux bond still intact.

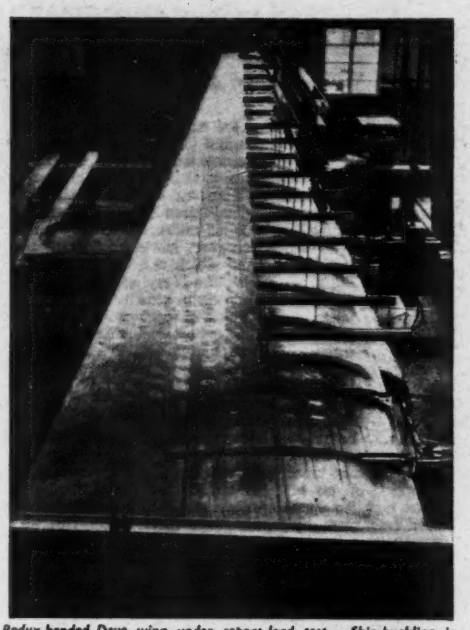
De Havillands have also carried out many tests. In addition to tests at room temperature, they have made compression tests on panels at high and low temperatures, as well as fatigue investigations. Perhaps the most interesting test that has ever been done on a Redux-bonded structure was made on the complete wing of a Dove aircraft. This wing was subjected to the following series of repeated loadings:—

cycles	load	cycles	load
1,200	0 to 2g	10,000	0 to 1.5g
500	0 to 2.45g	5	0 to 3.86g
5	0 to 3.4g	5	0 to 4.37g

After nearly 12,000 cycles of stress the wing was in perfect condition, and it was decided to subject it to static loading until failure. This occurred at 5.5 g, which was about 8 per cent above the design load.

The photographs give some explanation of why such good results were obtained. The appearance of the wing under load is quite different from that of one of riveted construction. In the latter, the buckles all run through the areas of stress concentration, i.e., the rivet holes. With a bonded wing it will be seen that the skin is held firmly along the whole length and the whole width of the stringers. Such a construction is stronger than one in which the skin is drilled with numerous holes for rivets and in which the load is transferred at these holes. With the stringers glued to the skin the buckles are localized between the stringers and are unable to run right across the wing.

Failure of Dove test-wing. Two stringers have fractured, but the bonding has remained intact except in small areas on each side of them.



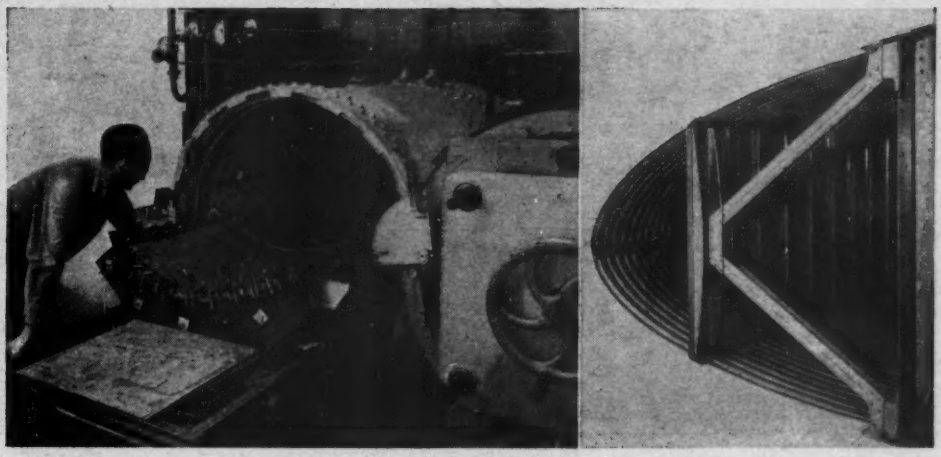
Redux-bonded Dove wing under repeat-load test. Skin-buckling is localized between stringers and does not run continuously across the wing.

When the Dove wing was examined after the completion of the test it was revealed that even where the metal skin had fractured, only one stringer had parted from it for a short length. Had a conventional riveted structure been subjected to a similar test it is probable that either the rivet heads would have come off or that they would have pulled through the 22 s.w.g. skin.

If confirmation of this test is required it may be found in the long experience which has gradually accumulated with the 300 Dove aircraft in service in many parts of the world.

After examining the results of these strength tests of various kinds on Redux-bonded structures, it is interesting to consider an example of how the weight of a structure may sometimes be reduced by changing from a riveted to a bonded design. The Bristol Aeroplane Company has made some servo-control tabs from 30 s.w.g. material, i.e., from sheet which is only 0.0124in thick, and which it would be almost impossible to rivet. These tabs are particularly interesting because there is not only the direct weight reduction on the tabs themselves but also the weight-saving on their balances. The total reduction is likely to be about 200 lb on the weight of tabs and balances for a typical four-engined airliner. Perhaps this figure will be more vividly appreciated if it is realized that it is roughly equal to the weight of one passenger and luggage.

Having considered some of the advantages which may result from the use of Redux, it is necessary to mention briefly the actual technique of bonding aircraft structures. Although, naturally, a glue is desired which will bond metals at room temperature, it has unfortunately not yet proved possible to develop a cold-setting adhesive that has sufficient strength, together with adequate resistance to tropical temperatures and humidities, and to common solvents (petrol, lubricating oil, and so on). It is a disadvantage that the Redux process requires a combination of heat and pressure for "curing," but the temperature is only 140-150 deg C, which is not sufficient to have any material effect on the mechanical properties of aluminium alloys, and which is not sufficient to render them liable to inter-crystalline corrosion.



Autoclave in use for bonding a half of a leading edge sub-assembly (Bristol 175) specially designed for this type of construction. The corrugated inner skin (right) is bonded to the smooth outer skin ; a structure of exceptional stiffness is thus obtained.

Pressures of 100-200 lb/sq in are all that is necessary, and in fact much lower ones have been used on an experimental scale and have given perfectly satisfactory results.

Most of the early production of Redux-bonded components has been carried out by the use of steam-heated hydraulic presses. At Aero Research, Ltd., Duxford, by whom the bonding process was developed, such a press has been used for many years to carry out bonding for aircraft constructors as well as for many other engineering firms. In their production of fuselage and wing panels for the Dove, de Havillands have used a similar but larger press. Their normal production method is to bond, in one operation, numerous stringers to skins about 12ft long by 4ft wide. The panels made in this way are then wrapped round and riveted to the wing ribs or fuselage frames. It is worth considering the amount of work required to jig-drill each rivet hole in the stringers and then in the skin (and afterwards to countersink each hole before actually doing the riveting) and to contrast this with the fact that after degreasing and chemical cleaning of the metal parts, they are all bonded together in one operation, requiring perhaps a total time of about half an hour.

A French aircraft constructor has used an electrically heated press to bond thin wood veneers to extruded aluminium-alloy wing spars. The temperature of the spar in the press is checked by a number of thermo-couples in small holes in relatively unstressed parts of the spar itself, and the pressure required for bonding is applied by means of a number of hydraulic rams along the length of the press. The same firm has also bonded wood veneers to light-alloy wing-ribs by clamping the parts together and curing the resin in an oven.

Although steam- and electrically-heated presses will no doubt continue to be employed extensively for Redux bonding, there are limits to the type of work for which they can be used. They are probably the most economical plant for bonding flat components or for those which are thin enough to be formed to shape after bonding, but they are not at all suitable for dealing with double-curvature panels. To overcome this difficulty the Bristol Company has adapted an autoclave to bond the leading edges of one of its new aircraft. The degreased and chemically cleaned metal parts are treated with Redux liquid and powder, placed on a curved jig, covered with a rubber blanket, and then put in the autoclave. Air is pumped into the autoclave to provide the necessary bonding pressure and then heat is supplied by an array of electrically heated mats under the curved jigs. Considerable ingenuity has been shown in this development of a technique which can be applied to an almost unlimited variety of double-curvature panels. It is also an interesting fact that the Redux joints made in an autoclave appear to be of a better quality than those made in a press.

Conclusion

In conclusion, it will be recognized that the change from riveted constructions to bonded assemblies requires something more than omitting the riveting and putting a glue in its place. For example, if extruded stringers with flat bases are bonded to an accurately curved skin, then some distortion must be expected in the finished assembly. It is evident that a flat surface cannot be glued over the whole of its area to a curved surface without some distortion occurring, whereas such a design may be suitable for riveting.

If full advantage of the gluing process is to be obtained, then the decision to use it must be taken at the design stage and production arrangements must be made accordingly. The use of the process often requires the introduction of completely new designs, or the modification of existing designs, and it certainly requires a big change in production methods. Sufficient experience has now been obtained to show that such changes are frequently justified by the results obtained.

HYMATIC TEST-RIG

WELL known as suppliers of compressed-air installations for aircraft, the Hymatic Engineering Co., Ltd., Redditch, Worcs, have recently introduced the first of a series of special test rigs to assist in the maintenance of their airborne equipment. Using the new rig, two inspectors can work side by side testing either pressure-regulating valves or oil and water traps.

The rig consists of an enclosed metal framework, measuring slightly over 4ft long by 2ft wide and 4ft high, which houses two single-cylinder, two-stage, stepped-piston, air-cooled compressors driven by vee-belts from a single electric motor. The compressors are connected by pipelines to the test-equipment pressure-regulating valves and oil and water traps and thence to duplicate 300 cu in air-receiving bottles. Maximum working pressure is 600 lb/sq in.

The top of the framework is covered in to form a workbench upon which two adaptors and dual sets of controls are conveniently mounted on either side of a central immersion tank used for the testing of Hymatic oil and water traps. Line and bottle pressure gauges, together with the two connecting pipes are located in an instrument panel.

Orders for these test rigs, it is stated, have already been received from Indo-China, Switzerland and Sweden.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

International Navaids

I READ the article "International Navigation Aids" (*Flight*, January 11th) with great interest, but what struck me most forcibly was the similarity between the proposals now being considered and those pertaining some five years ago. At that time the British Delegation to P.I.C.A.O. were strongly in favour of the Gee hyperbolic system as opposed to the American conception of beacons which were a further development of the British Rebecca/Eureka plus the development of their four-course range systems. It was finally agreed that the European Mediterranean Region could adopt a hyperbolic system of navigation, and the British Government did what the Americans are doing—they gave away a certain amount of equipment in order to get the plan started. This never came to anything, due to the high cost of the equipment and the lack of flexibility in the siting of the master and slave stations in relationship to airways.

A further drawback to its adoption was that all European airlines with the exception of British European Airways fly not only in Europe but on the trunk routes of the world. The problem here is that whilst it is simple to place one D.M.E./V.O.R., or a D.M.E./homing system only, on an airfield such as Bahrein, in order to fly there it is patently very costly to put down a chain of hyperbolic stations or track guides where slaves have to be placed at a considerable distance in the desert.

All hyperbolic systems have this great disadvantage for trunk-route flying and it is against this background of international flying that the picture should be judged, and not on a basis of what is locally desirable in Europe; otherwise, 80 per cent of European aircraft will have to carry two systems around the world for the benefit of the short-haul 20 per cent who do not go outside Europe. The alternative is to persuade all European countries to provide both ground systems.

W. GREGSON.

Edinburgh.

Insects and Aerodynamics

I REGRET the delay in responding to "Aeroapiarist," who suggested in your issue of December 21st that I might be able to throw some light on the anatomy of a honey bee.

I am flattered but somewhat embarrassed to be described as an aero-entomologist, since such knowledge as I possess is somewhat elementary and strictly limited to Lepidoptera.

I have put some enquiries in hand, but your correspondent seems to have raised a question which is awkward even for the experts. The first tentative suggestion which has been made to me is that the spikes he has detected on bees' wings are sensory organs. Such accessories are apparently known to exist on the wing surfaces of some of the Neuroptera.

If this is so, then the bee has much to learn about aerodynamics in relation to aerial design. Personally, I agree with the theory of your correspondent Dr. Murphy (January 4th) that the spikes are a deliberate but somewhat obscure method of boundary-layer control.

I hope to be able to give you a more informed answer at a later date.

S. SCOTT-HALL.

London, S.W.7.

Flying in the B-36

NO *Flight* article in recent years has given me more pleasure than that entitled "Visiting Giants" in the issue of January 25th. Its lively tempo of acute observation prompts me to add my own five cents' worth on the Convair B-36 global bomber.

On October 8th, 1948, I was present at the first Press show permitted by the U.S.A.F. in respect of this aircraft. Since it is still on the part-secret list, I will content myself with a few personal impressions.

As we prepared for a flight in the B-36 from Carswell Air Force Base I was amazed at the distinctive "hollow" note from another flying high overhead; it took me a long time to convince myself that I was not listening to the characteristic sound of a flying-bomb.

My particular aircraft was a B-36A powered by six 3,000 h.p. Pratt and Whitney R-4360-25 Wasp Major radials. It belonged to the 492nd Bomber Squadron of the 7th Bomb Group, 8th Air Force, Strategic Air Command. Our pilot was Major Husband, U.S.A.F. I settled down in the tail-end gunnery and rest "room," the huge plastic side-blisters making it possible to see the length of the fuselage. A friendly master sergeant suggested that when the motors started up I would be well advised to hang on to the rest-bunk structure. I laughed. Five minutes later I was holding on for dear life! Because of the extreme length and flexibility of the fuselage the tail waggles like a happy hound's during the warming-up session. But once we were on the move we surged forward smoothly and majestically. In the air, we rode the bumps with ease. From my port blister I watched the bogie main undercarriage gear slide into the wing.

Later, my attention was drawn to another mammoth moving up into formation. We were the lead ship and on each side we had an escorting B-36. For an hour and twenty-five minutes we toured over the State of Texas. In this time I had a chance to visit the front office. The 93ft connecting tunnel is traversed by means of a four-wheel trolley. One hops up and eases one's back on the seat and then grabs for a ropeline hung from the roof. The entry hatch is slammed and one is in darkness—a strange sensation—with only the increasing volume of motor noise to indicate positioning. Once past the mainplane, the noise decreases. The hatchway opens and one is out front. From the main office the view is terrific. Such a sense of complete power overwhelms one.

For the landing I went back along the tunnel, since I wanted to see how the bogie undercarriage behaved on impact. It worked like a dream. In no time at all we were taxying up to dispersal.

The B-36, despite all its many critics, is a tribute to the "bigness" and courage of the U.S.A. No other country, no, not even vaunted Russia, has the reserve of potential possessed by our great cousin nation. I for one am proud to proclaim my sincere admiration and gratitude. The B-36 may not win a war, but—better—it may help to deter unrestricted world conflict.

CHARLES W. CAIN.

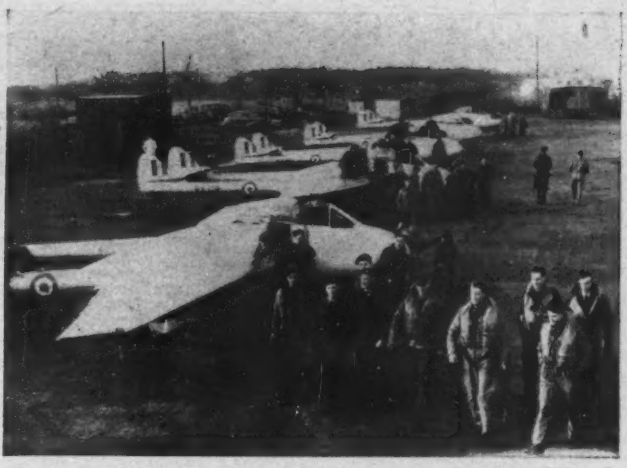
London, S.W.7.

FORTHCOMING EVENTS

Feb.	10.	Royal Navy *v.* R.A.F. Rugby, Twickenham.
Feb.	12.	Institute of Transport: Brancker Memorial Lecture—"Economic Aspects of Airline Operation," by Peter G. Masefield, M.A. (Eng.), F.R.Ae.S., A.F.Inst.A.E., G.Inst.Mech.E., M.Inst.T.
Feb.	13.	R.Ae.S. Section Lecture: "Derivation and Estimation of Aerodynamic Loads," by D. J. Lambert.
Feb.	14.	R.Ae.S. (Brough): "Aero Engines," by A. Cdre. F. R. Banks, C.B., O.B.E.
Feb.	14.	R.Ae.S. (Preston): "Testing Aero-engines and Power Plants," by A. C. Lovesey, O.B.E., B.Sc., F.R.Ae.S.
Feb.	14.	R.Ae.S. (Bristol): "Civil Engineering and Aeronautics," by A. G. Pugsley, O.B.E., D.Sc., F.R.Ae.S.
Feb.	15.	R.Ae.S.: "Some Aspects of Flight Research," by Handel Davies, M.Sc., F.R.Ae.S. (at Coventry).
Feb.	15.	R.Ae.S. (Portsmouth): Films: "Pluto" and "Welded Structures."
Feb.	16.	Institute of Navigation: "The American Plan for Air-traffic Control," by D. O. Fraser.
Feb.	17.	R.A.F. College Cranwell: .22 Shooting *v.* R.M.A. Sandhurst (away).
Feb.	19.	Institute of Welding (South London Branch): Visit to R.A.E., Farnborough
Feb.	21	R.Ae.S. (Weybridge): "Air Interception," by A. V-M. T. G. Pike, C.B., C.B.E., D.F.C.
Feb.	21.	British Institution of Radio Engineers: "Electronics and Air Transport," by C. H. Jackson, B.Sc., A.F.R.Ae.S., A.M.I. Mech.E.
Feb.	21.	R.Ae.S. (Leicester): "Welded Magnesium Aircraft Structures," by R. J. Cross.
Feb.	21.	R.Ae.S. (Southampton): "Undercarriages," by R. C. Cusons, M.A.
Feb.	22.	Institute of Metals (Birmingham Section): "Metals for Gas Turbines," by J. M. Robertson, Ph.D., D.Sc.
Feb	22	R.Ae.S. (Glasgow): "Thin-walled Structures," by Dr. R. M. Kenedi, Ph.D., A.M.I.Mech.E., A.F.R.Ae.S.
Feb.	22.	R.Ae.S. (Isle of Wight): "Interplanetary Flight," by A. V. Cleaver, A.R.Ae.S.
Feb.	23.	R.Ae.S.: Fourth Louis Bleriot Lecture: "Power versus Weight," by M. Maurice Roy.
Feb.	24.	Society of Licensed Aircraft Engineers: "Accident Investigation," by A.Cdre. Vernon Brown, C.B., O.B.E., M.A., F.R.Ae.S.
Feb.	24.	R.A.F. Reserves Club: Annual Ball.
Feb.	27.	R.Ae.S. Section Lecture: "Aircraft Wheels, Tyres and Brakes," by J. Wright, F.R.Ae.S.
Feb.	27.	R.Ae.S. (Belfast): "Aircraft Carriers," by J. L. Bartlett.
Feb.	27	R.Ae.S. (Bristol): "Human Factors and Civil Transport Aircraft," by K. G. Bergin, M.A., M.D., D.Ph., A.F.R.Ae.S.
Feb.	27.	Society of Instrument Technology: "Measurement of Surface Temperature," by Dr. R. C. Parker.

SERVICE AVIATION

Royal Air Force and Naval Aviation News and Announcements



GLASGOW VAMPIRES: Scene from Renfrew Airport, where No. 602 (City of Glasgow) Squadron took delivery of its first Vampires, bringing to 15 the total of jet-equipped Auxiliary Squadrons. Other Scots units whose Spitfires will soon be replaced are Nos. 603 (Edinburgh) and 612 (Aberdeen) Squadrons.

R.A.F. Reserve Training

MORE detailed plans have now been announced by the Air Ministry for recalling and training for 15 days 10,000 members of Class G Reserve—"those necessary to fill gaps in the control and reporting organization in case of emergency." Last Monday the Records Office were to begin sending "first warning" notices to the reservists liable to be recalled. The notices specify seven 15-day, Saturday-to-Saturday, training periods between June 2nd and September 8th. Reservists are asked to name, when acknowledging notices, three periods which would cause least inconvenience to them. Where possible, the R.A.F. will organize training dates according to the men's preferences.

The Service intends to give each man two full working weeks of training. Reservists will report to personnel transit centres for kitting-out and medical examination. At the P.T.C.s their ranks and pay-rates will be adjusted according to the new trade-structure which came into effect on January 1st. At the end of training they will be paid full rates, plus a £4 bounty, and released direct from training-stations. The Air Ministry expects that all warning notices, which take the form of a letter from the A.O.C Records, A. Cdre. R. Coats, will have been issued and acknowledged by mid-February.

Auxiliary Call-up

PROBLEMS likely to arise from the impending three-month call-up of R.Aux.A.F. fighter-squadron personnel were discussed at a commanding officers' conference at the Air Ministry last Friday. The meeting, under the chairmanship of Mr. Aidan Crawley, was addressed by Mr. Arthur Henderson and Marshal of the R.A.F. Sir John Slessor. The commanders of 17 of the 20 Auxiliary fighter squadrons were present, together with A.V-M. T. N. McEvoy, Assistant C.A.S. (Training); A.V-M. D. A. Boyle, Director-General of Manning; and A. Cdre. Finlay Crerar, Inspector of the R.Aux.A.F.

The call-up, of 2,300 pilots and ground-crew members of the squadrons, will probably take place in two phases, May-July and August-October. Re-equipment with jets, now three-quarters completed, will be speeded-up by the recall. Nine squadrons now have Vampires and six fly Meteors; the remaining five squadrons will exchange their Spitfires for jets during their extended summer training. Each unit will spend a month at an air-firing camp; the strain thus thrown on Fighter Command's limited gunnery facilities may cause some auxiliary squadrons to be posted abroad. It is, in any case, customary for some units to visit Germany during the summer.

R.N.V.R. Fireflies

AS forecast in *Flight* last week, the new R.N.V.R. air squadron now being formed at Culham, and eventually to operate from Ford, will be equipped with Fairey Fireflies. The aircraft will be of the latest Mk 6 anti-submarine type.

Raincoats for Airmen

VISITING R.A.F. Station Syerston last week, Mr. Henderson, the Secretary of State for Air, gave airmen the welcome news that raincoats were to be authorized for Service wear. To a questioner who had complained that "greatcoats were too hot and capes were ugly," Mr. Henderson said: "There may be a raincoat for you in due course, but I think you will have to pay for it yourself. We will be making an announcement about it shortly."

Canadian Naval Aviation

DESPITE an attempt at sabotage, the Canadian light fleet carrier *Magnificent* was due to sail from Halifax last Monday, as planned, for a five-week programme of exercises off Bermuda. On board were the Avengers of No. 826 Squadron and Sea Furies of No. 883 Squadron (together comprising the 18th Carrier Air Group). The Avengers are going to sea for the first time since their acquisition from America last year and subsequent modification as anti-submarine aircraft. In addition to the fully operational 18th C.A.G., the Royal Canadian Navy has formed the 19th Support Air Group, which will be based ashore at H.M.C.S. *Shearwater* (Dartmouth, Nova Scotia). This Group consists of 825 Squadron (Avengers) and 803 Squadron (Sea Furies).

Naval Pilots Wanted

THE Admiralty announces that, despite the Government's decision to re-engage for 18 months a number of Naval officers (including pilots), the recent offer of four-year re-engagements to former Naval pilots is still open. The offer, incidentally, has brought a good response, but ample opportunity exists for further applicants.

Pilots re-engaging on the terms offered should not be older than 33; they will receive a gratuity of £700 at the end of their four years' service. Applications should be made to the Secretary, The Admiralty (C. W. Branch).

R.A.F. Appointments

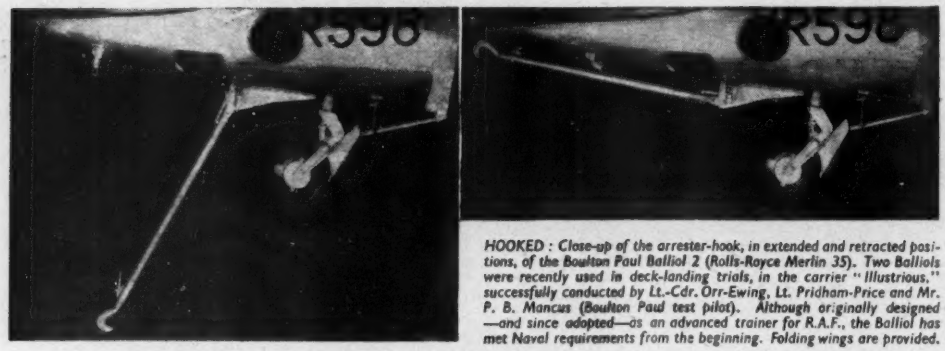
THE Air Ministry announces the appointments of A. Cdre. D. W. F. Bonham-Carter C.B., D.F.C., to Air Headquarters, Hong Kong, as Air Officer Commanding, and of A. Cdre. S. O. Button, C.B., D.F.C., as Director of Weapons at the Air Ministry.

A. Cdre. Bonham-Carter has been commanding officer of R.A.F. Station Brise Norton since August, 1949, and was formerly Deputy Director of Civil Air Operations, Ministry of Civil Aviation, from February, 1947. Soon after the outbreak of the war he was seconded to Headquarters, R.C.A.F. Training Command, from January, 1940, until May, 1943. After returning to the United Kingdom he served as a station commander in No. 5 Group, Bomber Command, for two years. During this time he took part in numerous operational sorties and was awarded the D.F.C. in March, 1945. Later he served for a year at No. 45 Group, R.A.F. Transport Command, in Canada, and was afterwards S.A.S.O. of No. 46 Group.

Educated at Winchester, A. Cdre. Bonham-Carter was commissioned from Cranwell in December, 1921. For a time he was a test pilot at the R.A.E.

The new Director of Weapons, A. Cdre. Button, was until recently Assistant Chief of Staff at H.Q., Air Forces Western Europe.

At the outbreak of war in 1939 he was serving at the Air Ministry in the Directorate-General of Operations but went soon afterwards to Headquarters, British Air Forces in France, where he remained



HOOKED : Close-up of the arrester-hook, in extended and retracted positions, of the Boulton Paul Balliol 2 (Rolls-Royce Merlin 35). Two Balliols were recently used in deck-landing trials, in the carrier "Illustrious," successfully conducted by Lt.-Cdr. Orr-Ewing, Lt. Pridham-Price and Mr. P. B. Mancus (Boulton Paul test pilot). Although originally designed —and since adopted—as an advanced trainer for R.A.F., the Balliol has met Naval requirements from the beginning. Folding wings are provided.

SERVICE AVIATION . . .

until the evacuation in 1940. Later he commanded No. 10 (Bomber) Squadron and in 1941 was given command of the bomber station at Pocklington, Yorks. Towards the end of 1941 he returned to the Air Ministry as Deputy Director of Bomber Operations, becoming Director in 1943 and holding this appointment until June, 1945, when he went to the Middle East to command the Egypt Group.

On his return to England in 1946 he took the Imperial Defence College course; at the end of that year he joined the Central Bomber Establishment and commanded its tactics wing until his appointment to Fontainebleau in December, 1948.

Educated at Dean Close School, Cheltenham, A. Cdre. Bufton was commissioned in the R.A.F. in December, 1927.

Far East Ambulances

SINCE its formation six months ago the Far East Casualty Evacuation Flight, equipped with three Westland-Sikorsky S-51 helicopters, has evacuated 21 patients from the Malayan jungle. The total may seem small at first—until it is remembered that many hundreds of miles have to be flown, often in bad weather and under difficult navigational conditions. The success of the helicopters is officially described as having exceeded all expectations.

The 21st casualty evacuated was a native soldier of the Malay Regiment. He was lifted from a small clearing in dense jungle in North Perak in weather described by the pilot as the worst he had seen in Malaya; the S-51 was forced to keep in sight of the escorting A.O.P. Auster throughout to retain sense of horizon. Activities of the helicopters in Malaya were described and illustrated in *Flight* of January 18th.

Auxiliary Appointment

THE appointment is announced of Air Marshal Sir John E. A. Baldwin, K.B.E., C.B., D.S.O., D.L., J.P., as Honorary Air Commodore of No. 3506 (County of Northampton) Fighter Control Unit, R.Aux.A.F. Sir John, whose service career began with the 8th Hussars in 1911, retired from the R.A.F. in December, 1944. He spent the first part of the war with Bomber Command, becoming acting A.O.C.-in-C. in 1942. His last appointment was as A.O.C., No. 3 Tactical Air Force, operating in Burma.

Anglo-American Fleet Exercises

THE British Mediterranean Fleet, operating under the command of Admiral Sir John Edelsten, the U.S. 6th Fleet, under the command of Vice-Admiral John J. Ballentine, and the British Home Fleet, commanded by Admiral Sir Philip Vian, will hold joint exercises in the Mediterranean on February 12th and 13th.

The combined exercises will be the largest held since the close of World War II; incorporated in the three fleets will be vessels ranging in sizes from carriers and heavy cruisers down to frigates and other small craft. Both British and American aircraft—land-based flying-boats and carrier-based aircraft—will take part.

Rear-Admiral C. D. Glover, U.S.N., Commander Carrier Division 4, will be in tactical command of the American naval air operations, while A.V-M. N. H. D'Aeth, R.A.F., Air Officer Commanding Malta, will have supervision of the operations of the aircraft flying from shore bases in their attacks on the carrier task force and other surface units.

The Home Fleet Commander, Sir Philip Vian is flying his flag in the battleship *Vanguard;* the Fleet's supporting carriers are the *Indomitable* and *Indefatigable,* both of which proceeded independently to join the Fleet, already at Gibraltar, within the last few days.

Appreciation

AS recorded in a previous issue, the 17th Carrier Air Group, based in H.M.S. *Theseus,* has been awarded the 1950 Boyd Trophy for its achievements in the Korean campaign. The Fifth Sea Lord has received the following signal from the *Theseus* :—

"Your message is very much appreciated by all on board. We are all very mindful of the long chain of effort which makes our small achievement possible, and hope that any success out here will be some reward to all those doing an unspectacular but essential part of the job elsewhere."

Reunions

NO. 708 Naval Squadron.—Fifth annual reunion dinner at Simpsons-in-the-Strand on Friday, March 2nd. Details from H. T. Molyneux, Sarre Court, Sarre, near Birchington, Kent.

* * *

No. 3 G.T.S.—Fifth reunion dinner at The Barley Mow, 104, Horseferry Row, London, S.W.1, on Saturday, March 10th, at 1800 hr. Tickets (10s) from Joan E. Sherman, 121, Ashfield Road, Southgate, London, N.14.

* * *

No. 110 Squadron (Bangalore to Singapore).—Reunion dinner on Saturday, March 10th, at Chez Auguste Restaurant, London, W.1. Tickets (12s 6d) from E. H. Algar, 147, Sutton Common Road, Sutton, Surrey.

* * *

R.A.F. No. 2 Group Officers' Association (including 2 Group units past and present).—Fourth annual meeting and dinner on May 5th. Details from F/L. Beattie, 6, Leamington Road Villas, London, W.11. Special welcome to W.A.A.F. officers.

B.U.A.S. BALL : Pictured at the recent annual ball of the Birmingham University Air Squadron are (left to right) : Dr. C. N. Chitnis (M.O., R.A.F. Station, Castle Bromwich) : S/L. J. A. C. Aiken (commanding officer) ; Mr. C. G. Burton (secretary, University of Birmingham) ; F/L. A. Asker (adjutant, No. 605 Sqn.) ; and S/L. J. Timmis (C.O., No. 605 Sqn.).

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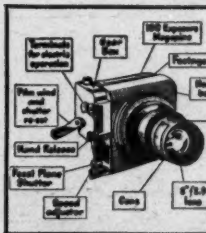

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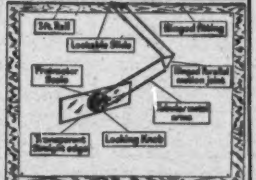

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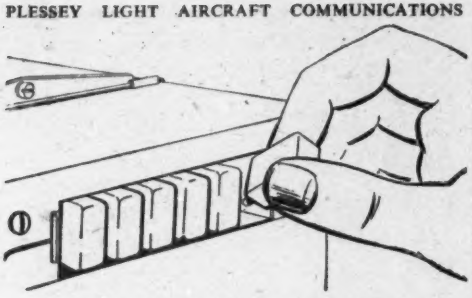

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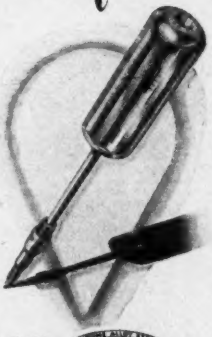

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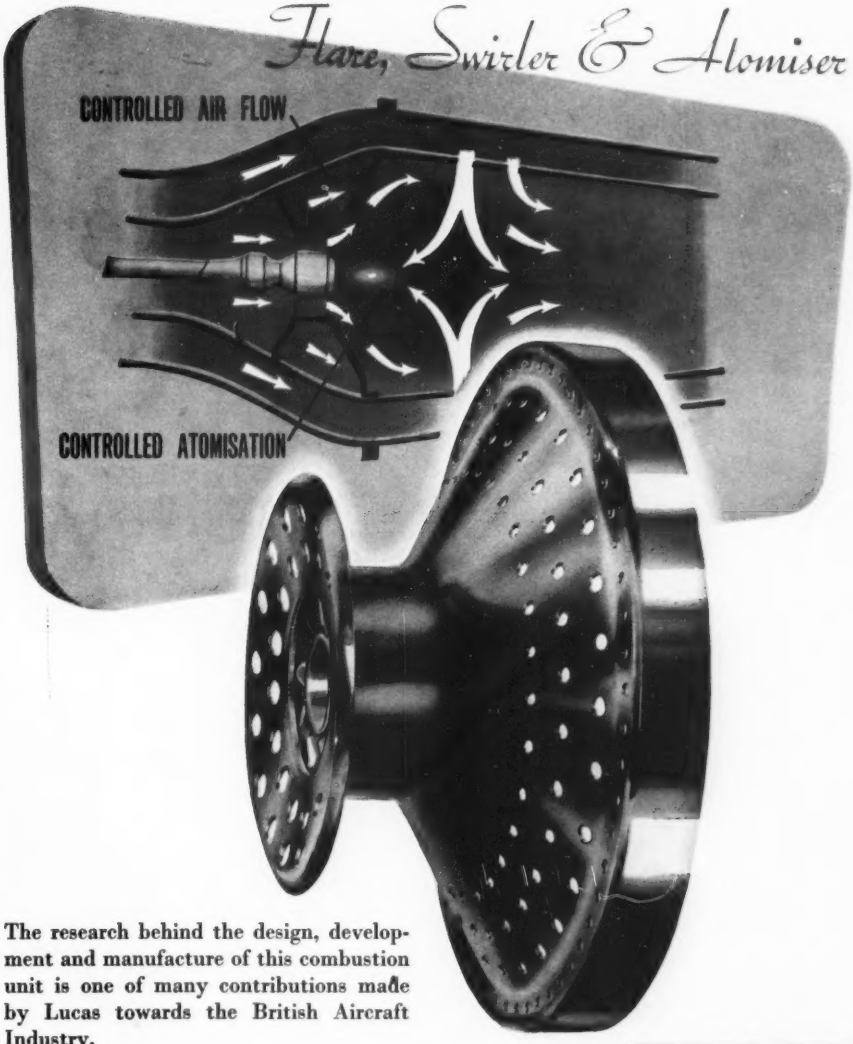

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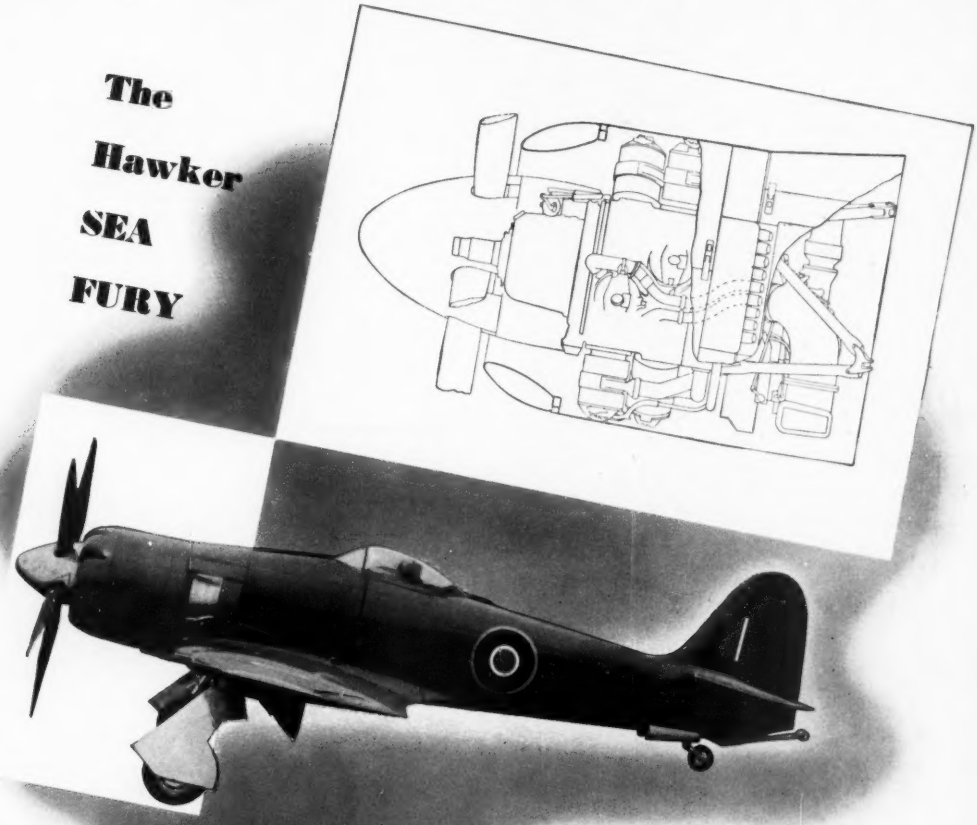

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